Railway Age Gazette
MECHANICAL EDITION
INCLUDING THE
AMERICAN ENGINEER

PUBLISHED ON THE FIRST THURSDAY OF EVERY MONTH BY THE
SIMMONS-BOARDMAN PUBLISHING COMPANY,
WOOLWORTH BLDG., NEW YORK, N. Y.

CHICAGO: Transportation Bldg. CLEVELAND: Citizen's Bldg.
LONDON: Queen Anne's Chambers, Westminster.

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Subscriptions, including the eight daily editions of the *Railway Age Gazette* published in June in connection with the annual conventions of the Master Car Builders' and American Railway Master Mechanics' associations, payable in advance and postage free:

United States, Canada and Mexico.................. $2.00 a year
Foreign Countries (excepting daily editions)........ 3.00 a year
Single Copy .... 20 cents

Entered at the Post Office at New York, N. Y., as mail matter of the second class.

WE GUARANTEE, that of this issue 4,300 copies were printed; that of those 4,300 copies, 3,835 were mailed to regular paid subscribers and 100 were provided for counter and news companies' sales; that the total copies printed this year to date were 50,576—an average of 4,598 copies a month.

VOLUME 87. NOVEMBER, 1913. NUMBER 11.

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Engine House for Mallets

The engine house recently completed by the Baltimore & Ohio at Cumberland, Md., is of interest mainly because it provides for the housing of Mallet locomotives. The number of engine houses for Mallets is increasing, although as yet it is by no means great, the Delaware & Hudson and the Norfolk & Western being among the leaders in this step; but, as one of the points urged strongly against the use of Mallets when this type of locomotive was first introduced was the difficulty of providing suitable facilities for housing and caring for such large motive power, it is worthy of note that the Mallet type has advanced to a position in the moving of railway traffic which provides an answer to the question of the economy of providing special facilities.

Locomotive Tool Equipment

It is a surprising fact that on many railways there seems to be little or no systematic attention directed to the care of locomotive tool equipment. If a locomotive stands in the engine house for a few days it is almost invariably necessary to furnish a new hammer, monkey-wrench, shovel, etc., and probably new classification lamps, all because the precaution was not taken to remove and store the tools when the engine was taken out of service. The locking of tank boxes as a remedy may be set aside as unsatisfactory if not entirely useless; no padlock will withstand more than a few blows from a hammer, and in the smoke and steam of an engine house it does not require a thief of any special attainments to make a clear get-away with the contents of a tank box. A frequent procedure is to leave a set of worn-out tools in place of the good ones removed, and if anything this is more aggravating than a mere theft. If the engineman next assigned to the locomotive is good natured enough to start his trip with such equipment he may find himself in trouble on the road, and to withdraw a set of new tools from his little stock, achieved after many blue penciled requisitions, and to receive in exchange perhaps a useless monkey-wrench and two or three battered oil cans, always causes a tearing at the heart-strings of the foreman. The remedy for these difficulties—the provision of an adequate system of checking and caring for such equipment—seems so simple and may be productive of so much saving that it is extremely difficult to understand why so few roads make any real effort along these lines.

College Men and the Railroads

The communication of I. I. W. and the editorial in the October issue of this journal have resulted in a number of communications which clearly indicate the interest that exists in, and the difficulty of the problem. At our request a number of the more prominent educators and apprentice supervisors on railroads have furnished us with their opinions and suggestions. Space would allow the insertion of but two in this issue. Others will be printed in later numbers. Both Messrs. Humphreys and Buell indicate solutions for some of the difficulties. The latter discusses what is probably the most important feature in the whole problem, which is the lack of understanding of so great a proportion of the college men who come to railroads of what they actually want to do, or of the difficulties that lie in the path to any goal in the railroad service which they may decide they wish to reach. Mr. Humphreys points out a fault which undoubtedly does exist in a great many cases, which is the failure of the railroads to conduct their apprenticeship courses efficiently so that a college man is permitted to supplement his previous training in engineering. He believes that an adequate apprenticeship railroad course for engineering graduates could be covered in two years if these men are required to work at high pressure. We will be glad to have the opinion of college men who have made a suc-

cess of railroading showing how, in their opinion, either the college courses or the railroad method of handling the graduate could be improved. Also from those who have left the railroad service, outlining the conditions which they found to be unsatisfactory.

Car Department Competition

At the beginning of this year a prize competition was opened for articles relating to the work or interests of the car department. The interest taken was gratifying and the responses were most satisfactory, but after carefully studying the articles submitted, it appeared that there was still a large proportion of the more important work, in connection with the design and maintenance of cars, that was not covered by any of them. It is therefore decided to open another competition along the same lines and a prize of $50 is now offered for the best article of this kind which reaches this office before February 1, 1914. Articles considering any subject that is of general or special interest to the car department will be considered.

In order to give a suggestion of a few of the subjects that might be selected for treatment the following can be mentioned: Methods employed for bringing weak cars up to a condition of strength to safely stand the use and abuse they will receive in service; organization and equipment for the best handling of bad order cars in yards; how to avoid leaky roofs on wooden superstructure box cars; features of design that lead to a reduction of claims for lost or damaged freight; ventilation and heating of steel passenger equipment; analysis of the stresses that are set up by the shocks of severe hump yard service in the important members of the car framing and attachments; proposed design of a shop for making heavy repairs on all-steel equipment of different classes, including freight and passenger, showing the required equipment and its best arrangement and an outline of the organization of the forces; the labor situation in a repair yard. These are simply suggestions of a few of the many subjects that can be selected, and contestants are in no way restricted in their choice of subjects, except that they must refer to something of interest to the car department. Three months' time is allowed on this competition, which should be ample to permit a thorough investigation and study of all the conditions of any subject selected by any contestant for his article. Any further information desired in connection with this competition will be gladly supplied. Articles considered suitable for publication which do not win the prize will be paid for at our regular space rates.

The Diesel Locomotive

A passenger locomotive of moderate size driven by a Diesel engine has recently been built in Switzerland, and is now in experimental service in Germany. The arrangement, as will be seen by reference to the description given in this issue, provides for a direct drive between the engine and the wheels. So far as we know, this is the first instance where an internal combustion engine has been directly connected to the wheels of the vehicle which it drives. This arrangement would seem to have a number of serious disadvantages. In the first place it makes it necessary to have a reversible engine which introduces further complications in a machine which, at the best, is far from being simple. Furthermore, it requires the compressing and storing of air at high pressures for giving the required starting torque. In this case a 250 horse power Diesel engine with a large, three stage air compressor, together with a number of reservoirs capable of holding high pressures, have been included, entirely for the purpose of starting the locomotive. Air pressure is used for running the locomotive until it attains a speed of between five and six miles an hour.

It has been estimated that fully 75 per cent. of the cost of fuel will be saved by using a Diesel engine as the source of power for a locomotive. This comparison is based on the cost of fuel in Europe. In view of this, it is to be expected that every effort will be made to adapt this type of engine to a locomotive, but it does not seem that the present arrangement is the most practicable. The difficulties of designing a satisfactory clutch to carry the full power of a large locomotive will be readily appreciated, and even if one was built, the necessity of reversing the engine is still present. A. P. Chalkley, in his book, "Diesel Engines for Land and Marine Work" (1912), states that, "at the present time it is hardly unfair to say that the Diesel motor is too delicate an engine to stand the great strain that would be put on it under working conditions when used for locomotive driving, and that its method of operation should, as far as possible, be the same as with ordinary engines. This, apart from other considerations, such as greater starting torque, and more easy and economical variation in speed of running, brings up naturally to the question of the employment of electricity as an intermediary between the engine and the driving wheels of a locomotive, and it is upon these lines that we may expect more immediate development." He suggests further that it is probable the Diesel electric locomotive, which may be expected in the future, will be of a type in which alternating current dynamos and motors will be employed. This would seem to be a much more practicable arrangement for taking advantage of the economy offered by the Diesel engine for the hauling of trains, and it is probable that a construction of this kind will make its appearance in the not distant future.

Organization of Engine Houses

An individual paper by Walter Smith presented at the last convention of the General Foremen's Association, reviewed the subject of engine house organization and operation in a very thorough and helpful manner. Unfortunately there was not time for any discussion on this paper and the subject will be brought up again at the next convention. Not the least important part of Mr. Smith's comment is the section on organization. Proper organization, suited to the conditions and the local requirements, has proved of great value for the efficient operation of divisions, departments and large shops, and there is no reason to expect that it would be of less value in such an important place as a locomotive terminal. Mr. Smith claims that it is the keynote of the whole situation and that even where all conditions are favorable and modern facilities are provided, if the organization is not on a firm basis the results obtained will be inefficient. He points out that in an efficient roundhouse organization the foreman and each workman should have his duties clearly defined and should be given to understand that he is responsible for the work he performs. It also provides for the loss or transfer of workmen or foremen and an available substitute for every important position. He claims that there is no question but that the inefficiency of many engine houses is due to the lack of supervision and that an organization to be efficient must relieve the foreman of too much detail work. The paper goes into some detail in outlining the most suitable form of organization and discussing the duties of the various men.

A few years ago at a large engine house where the organization was almost perfect, it was necessary to reduce the working force by about 50 per cent. The indications were that the slack times would be of comparatively short duration, and it was believed advisable to hold the organization intact, even though there seemed to be a great predominance of, so called, non-producers or foremen. In view of the large number of foremen and sub-foremen it was expected that the cost per engine turned would be increased, but the advantage of holding the organization together was felt to largely offset this. After settling down to the new conditions for a few months every one was surprised to find that instead of the cost per engine turned going up it was actually decreased over what it had been

with the larger force. A careful analysis of the whole matter finally led to the conclusion that the decreased cost was entirely due to more careful and thorough supervision. Each foreman now having fewer men under him and fewer locomotives to handle was enabled to give his department closer attention and, although his salary was a decidedly larger proportion of the payroll in his department than had been the case theretofore, he was able to more than offset it by more efficient work. This is but an instance of the value of so arranging the organization of a roundhouse, or any other force, that the foremen will be given ample time for thorough supervision and not be loaded down with detail work.

Air Brake Hose

Circular No. 14 of the Master Car Builders' Association gives the new specifications for air brake and signal hose, air brake gaskets, and the label for air brake hose which were adopted by special letter ballot in July of this year. The new specifications are practically those proposed by the committee at the last convention and, in many respects, are much more severe than those heretofore in force. There has been a general feeling for some time that a better grade of air brake hose was needed, although there was considerable difference of opinion as to just what form the improvements should take. The committee investigated the whole matter most carefully and the new specifications are evidence that its conclusions are in favor of a better grade of rubber and that, having this, the manufacturer should be allowed even greater freedom in his methods than heretofore. The former specifications required a three calendered tube, each calender being 1/16 in. in thickness. It is doubtful if this was actually obtained in many cases. The new specifications allow the tubes to be made either by hand or machine and contain no requirements as to number of calenders or thickness of each, although the whole tube shall not be less than 3/16 in. thick at any point.

Two entirely new tests have been added, and most of the others have been increased in severity. The porosity test is to insure that there are no minute holes in the inner tube which will allow a gradual leakage of air. For this test a hose is filled with air at 140 lbs. pressure for five minutes, and at the end of this time the rubber cover is split with a knife and the hose is submerged in water. Any distinct escape of air will be sufficient to condemn the whole lot. The other new test is one for the tensile strength of the tube and cover. This has been inserted as a check to insure the use of natural rubber, and requires that the test piece shall be pulled in a tensile machine with a test speed of 20 in. per minute. After an elongation of at least 10 in. the inner tube must have a tensile strength between 800 lbs. and 1,200 lbs. per sq. in., and the cover between 700 lbs. and 1,100 lbs. per sq. in.

It is thought by the committee that these two new tests will insure a quality of material which will meet more severe requirements in some of the other tests. The new bursting test requires a hydraulic pressure of 200 lbs., or double that previously used. Under this pressure the hose must not expand more than three-quarters of an inch in circumference. Previous tests allowed an expansion of one-quarter inch, but did not specifically state whether it was of diameter or circumference. The new tests also require a hydraulic pressure of 500 lbs. per sq. in. for 10 minutes without bursting, while the former test required a pressure of but 400 lbs. for this purpose. There was no change made in the friction test but stretching test has been increased from 8 in. to 10 in. for both the preliminary and final stretch and a new requirement that the initial set shall not be more than one-quarter inch within 30 seconds after the time of the last release has been included. After 10 minutes the new tests will not allow a permanent set of more than one-eighth inch where one-quarter inch was previously permitted. This test applies both to the tube and the cover.

While previously there was no test made of the quality of material used in the wrapping, the new specifications require the breaking of a single strand of the warp or filler which strength multiplied by the number of the warp or filler strands per inch shall not be less than 220 lbs. The new hose must be not less than four ply and some changes have been made in the variation permitted in the size. A new label was also adopted by the same special letter ballot.

Of course the new hose is going to cost more than the other and it is probable that it will be sold for about 60 cents a foot, or approximately 50 per cent. more than the average price of the hose manufactured to the old specifications. This represents a very substantial sum which the increased length of life of the hose will amply repay if it is allowed to remain in service until deterioration, due to age, makes it unsafe. Failures due to mechanical injury, which on some roads seem to be the chief cause for removal, will not be prevented by the new hose any better than they were by the old, and it is to be hoped that the increased cost will lead to greater care in the mounting of the fittings, the condition of the couplings and the proper application to the car.

J. S. Sheafe, engineer of tests of the Illinois Central, in the *Railway Age Gazette,* October 17, points out that with the better hose, deterioration will cause failure eventually, although it will have a longer life than the poorer grade, and he suggests that if a certain brand of hose is known to be able to give so many months' service, it should be removed at the end of that time. It is impracticable for car inspectors to continually examine the hose labels as they are now applied, and he recommends that large figures be vulcanized on the outside of the hose near the coupling which will show the month and year in which the hose will have reached its allowable maximum age and should be removed. With these figures easily visible the car inspector will remove the hose from service when the time has expired as he can easily discover it without effort, and there will be no opportunity for the hose to remain on a car until it is so deteriorated that bursting under train line pressure will be inevitable. This suggestion would appear to have many advantages on the side of safety.

NEW BOOKS

The Science of Burning Liquid Fuel. By W. N. Best. Illustrated. Bound in cloth. 153 pages, 6 in. x 9 in. Published by the author at 11 Broadway, New York. Price $2.

The author has devoted much time to the study of burning fuel oil and has endeavored to make this book thoroughly practical. Analyses of oils from different localities are given and a chapter on atomization gives illustrations and descriptions of different oil burners. The systems in use for burning oil as fuel are considered, theoretically and practically, and locomotive stationary and marine applications are described. Considerable space is devoted to the equipment for ovens and furnaces. There are a large number of illustrations.

Safety First. By George Bradshaw, Safety Engineer. Illustrated, bound in paper, 129 pages, 5 in. x 7½ in. Published by the McGraw-Hill Book Company, 239 West 39th street, New York. Price 50 cents.

Mr. Bradshaw is one of the most active and has been one of the most successful leaders in the safety first movement on railroads. He has given the whole subject the most careful and detailed study and has prepared a most impressive series of photographs showing how the minor accidents on railroads are frequently caused, which, together with explanatory notes, are now bound together to form this book. The scenes illustrated are familiar to all railroad men, and are usually the result of carelessness on the part of some one. Correcting them costs little or nothing in either money or effort. The photographs should be seen by every railroad man whose duty takes him either into the shop or out on the road.

COMMUNICATIONS

COLLEGE MEN AND THE RAILROADS

[A large number of very interesting communications on this subject has been received, but the limits of space will allow the insertion of but two in this issue. Others will appear in December.—EDITOR.]

OMAHA, Neb., October 23, 1913.

TO THE EDITOR:

The subject of the communication of I. I. W. and the editorial in the October issue is a matter that has been discussed pro and con for years, both in mild form and otherwise. There must be some basic trouble. Have we hit on it yet?

The problem of the college man to the average practical railroad official may perhaps be summed up somewhat as follows:

First: When the college man applies for a position he has no definite idea of what he wants to do, what he wants to become, or what method he should follow to achieve his cloud-obscured goal. In many cases he is "wished on" the official in question.

Second: The college man first starting to work is full of protestations as to his willingness to do anything which is laid out for him to do.

Third: Almost from the day the college man begins any assigned work his abnormal impatience begins to make itself manifest.

Fourth: It seems impossible to satisfy such a man either with a routine of work or with normal increases of pay, or promotions.

Fifth: If the college man is acquainted with any of the higher officers of the road or has any "influence," in the majority of cases he begins to write letters of complaint or criticism which filter back to the officers who are trying to handle him.

Sixth: The college man, generally speaking, is inordinately selfish, in that without respect for the loyalty or years of service of trusted employees of a road he expects to be set above them. His conceit is such that he deems himself more competent than these older employees.

Seventh: Generally speaking, the college man's perspective is so limited that he does not realize the importance of that most important element of official success; namely, the ability to handle men, without which, knowledge or practical experience, or both, must be greatly discounted as items of weight in the consideration of promotion possibilities.

Eighth: Selfishness again appears among college men in their utter disregard of the fitness of things as regards "laying off," taking vacations, asking for transportation, special favors, etc. These are elements that make for disorganization in a time-tried and loyal force of workers.

Do not misunderstand my point of view. It is admitted that in some cases college men with the proper requisites for success are mishandled by railroads. There is much to criticize on the other side, but let us first get at some of these most striking primary conditions and ask ourselves why these conditions exist.

There is in Boston an organization known as a Vocational Bureau, the object of which has been to make a careful study of the different industries commonly entered by boys and girls, so that the vocational guidance of youth could be efficiently undertaken by these broad-minded founders, and young folks thereby aided to successfully enter professions in which, according to all indications, they could make more or less progress. The converse of this being that youths would be advised against entering professions in which there was every probability of their failing to achieve success.

I do not believe there are more than a very few of our universities or technical schools wherein intelligent and practical vocational guidance is given to the members of the graduating classes. My experience in handling a considerable number of college men who have wanted to start railroading has been that few if any of them have any intelligent idea as to the organization of a railroad; as to the functions performed by the various departments; as to the duties of the various minor officials of the different departments; as to the hours of service of these officials, their salary, their requirements as to intelligence, practical experience, technical knowledge, etc. In other words, the college man when turned out into the world is equipped with a certain amount of knowledge which he is ready and anxious to apply, although he is not equipped with accurate information as to where he can best sell his services or best apply his knowledge.

It is also true that in most cases the college graduate has no idea of what he wants to be. In other words, his ambition has not assumed the form of a definite ideal or concept. Those who want to be railroad men in the majority of instances do not know why they want to be railroad men; in fact, don't know what a railroad man is, what he does, or what he needs to know.

It is also true that most railroad officials are not experts on the subject of vocational guidance of college men. Many of them are too busy to take the time to go into the subject thoroughly, and many of them have been so disappointed with past experiences with college men as to have lost all interest in college men in general. The result is that in the majority of instances a college man is given a job without any particular investigation on his part as to what it will be or where it will lead to, and without any particular interest on the job-giver's part as to whether the man is fitted for railroad work or is started in a manner to lead to ultimate success. With such a hit-or-miss manner of getting and giving railroad jobs why should it be expected that any considerable percentage of college men would stick to railroading?

Let us paint another picture. A young man, either before entering college, or while in college, makes up his mind that he wants to be the general superintendent of a railroad. In other words, while still a young man and unformed he has analyzed his desires and analyzed railroad conditions so that he has firmly convinced himself that considering his intelligence, his opportunities for training, his strength, his desire, etc., he is justly entitled to steer toward a reasonable goal of ambition; that is, the general superintendency of some railroad company. What is the first thing he should do? He should by all means find out just as thoroughly as possible what duties, hours of service, necessary knowledge, practical experience, wages, perquisites, etc., are a part of such a position; in fact, he should have found out most of these things before making up his mind that he wants to be a general superintendent, but having once made up his mind and having ascertained the fundamentals required for such a position he is then ready to square about, to steer his course in as straight a line as possible for this chosen harbor.

He finds out many other things—that a general superintendent must be a thorough operating man, must have sufficient knowledge of motive power and mechanical matters to intelligently deal with such mechanical matters as come within the scope of his jurisdiction, that he must, on practically all railroads, be a first-class track man, that he must have big capacity for the handling of men, and in fact a thousand other qualities that go to make up the equipment of a successful operating official. This young man equipped with such knowledge and insight is not troubled with conceit as to his knowledge, is not consumed with impatience, is less prone to be supremely selfish, and has learned his first great lesson; that is, that there is so much for him to learn that he can't overlook any opportunity for getting information of every kind and description.

If this man is of the right calibre he will plan out his own course of action. He will know long before he leaves college what is the first job that he must tackle to get experience. He

may choose to go to work as a section laborer, he may choose to go to work as a locomotive fireman, he may start in as an apprentice in the shop, or he may go braking or switching, or work as a yard clerk, or enter station service—it makes little difference, although if he is wise he will so plan his line of action as to get his dirty work and his poorly paid work done as early in the game as possible.

He realizes with great humility that he cannot hope to get personal practical experience in all of the lines of work, so he works with an active brain, with wide-open eyes and tightly-closed mouth, except when using his mouth to ask intelligent questions which he has previously carefully formulated in his mind.

Such a man if he goes braking will learn all about an engine, will fire half the way over the road on every trip and get his locomotive experience in combination with his train service experience. Such a man will never lose an opportunity to talk to anyone about railroad work. He will, in an inoffensive way, be poking his nose into everything. In fact, he will be so busy learning things that he won't have time to "holler" about lack of appreciation of his work, partiality and kindred other things, and he will be learning so fast and so much that instead of kicking about more pay he will feel that the check he receives at the end of the month is but a small part of his real income. He will automatically make himself so valuable in a short time that he will begin to get special work, small promotions and opportunities for acquiring a further knowledge, etc.—not as sop to keep him satisfied, but because the railroad needs such men and ninety-nine times out of a hundred takes mighty good care of them.

Such a man in his first period of practical work will live with, and be one of, the men, and he will get an insight into human nature and the peculiar methods of thought of railroad employees that will be invaluable to him in justly and sympathetically dealing with these classes of employees in later years when he is in an official position.

Will this man expect to be a general superintendent at the end of four years of training? No! Nor at the end of twenty, perhaps, but he is on his way all the time and he realizes month by month and year by year his steady progress toward his goal, and as he progresses through the minor positions, is transferred from point to point and attains age, he may perhaps glance higher up and begin to apply the same reasoning powers and methods to the position of general manager, or vice-president in charge of operation, or president, or chairman of the board, and if he aims high enough and persists he will ultimately arrive, if not at the very top, then mighty close to it.

But what of the poor, rudderless, compassless college man who wants to be a railroad man but does not know where he wants to start in and does not know what he wants to do? He has no idea what work such as he can do is worth. He is given a "job." He does not know what he ought to have, but he is pretty sure that what he has is not right and he begins to kick—he does not know what for, but for something different. Generally speaking, the railroad is well rid of the percentage that it loses of such men.

Why should the railroad have to maintain a vocational bureau? Why should it be up to a busy railroad official to tell a college man how to start in railroading? Why should the railroad have to have special courses, special apprenticeships, special studentships, to take care of college men? What is the college for if it has not fitted the graduate to intelligently approach his life's problem? Why should not every university have a department of vocational guidance or an assigned course of study, the sole purpose of which would be to aid and instruct the student in the business of life?

The poor boy with a common school education, good health and character starts out at twenty years of age as an equal with other employees in character and manhood; associates with them, obtains their support, and starts at once to learn and succeed.

The college boy has learned it all at twenty years of age, considers himself superior, and lacks the support of his associates; discovers his mistake after four or five years work, and possibly at the age of thirty years gets down to business.

Taking the poor boy at thirty, who has made continuous advances, and the college boy at thirty, who has learned to make advances, the latter will probably have better chances for advancement than the poor boy on account of his superior education and training provided he has equal sense and the application of the other.

I will say from personal experience that the college man, who knows what he wants, finds a way to get it on a railroad. He sticks and makes good. It is the fellow with the useless rudder, the defective compass, or the broken-down engine that gets on the rocks of discontent.

D. C. BUELL.

NEW YORK, October 14, 1913.

TO THE EDITOR:

In discussing the communication of I. I. W. and the editorial comment thereon, both in the October issue, I shall speak from my experience as an employer of college graduates as well as from my experience later in life as the president of Stevens Institute of Technology.

I was the first in my specialty to employ, systematically, engineer graduates. I established a cadet corps in which these young men were trained, as rapidly as consistent with thoroughness, for advancement into responsible positions. While I insisted that they should go through the grades and learn to do with their hands, I did not expect to teach each one of these men to be as expert mechanically in every branch of our work as the mechanics who had devoted a lifetime to a single specialty. But I did expect these men, with their superior preparation, to learn quickly and thoroughly the practical essentials in all branches of our work, and to be able to direct accordingly.

I confess that I sympathize with I. I. W. far more than I usually do with the complaints of engineer graduates. As usual, there are faults on both sides; and, in addition, there are great difficulties on both sides, the faults of no one in particular but due to the inherent difficulties of the problem. Most of the difficulties could be eliminated by the complete, open-minded and intelligent co-operation between the schools of engineering and the employers.

I fear that some of our railroads are failing to conduct their apprenticeship courses efficiently. Engineer graduates should not be subjected to a course which is not competently designed to supplement the previous college training in the science of engineering. I am strongly of the opinion, and here I agree with I. I. W., that an adequate apprenticeship railroad course for engineer graduates could be covered in two years. These graduates should be required, if necessary, to work at high pressure to cover the ground in two years. Evening classes for, say, three nights in the week should be so conducted that the students could, under the guidance of competent men, trained in theory and practice, be led more quickly to understand and appreciate the practical application of engineering science to the requirements of the shop and field. And the majority of these men—those of stamina—under proper guidance, would, I believe, respond to the demands so made on them. Unless these engineer graduates are to receive special treatment as apprentices, which will shorten the term of their apprenticeship, they might better follow some other line of study in the school of experience.

As far as compensation is concerned, I do not think the apprentices would have much cause for complaint, provided they were given the proper opportunity to get a thorough experience training without unnecessary loss of time and effort. I have always held with my cadet engineers that they did not

earn their wages at first (the lowest I have ever paid is $50 a month)—the period depending upon the personality of the man. These cadets were being paid to take a special post-graduate course in the school of experience. I am also of the opinion that it is a mistake to pay these cadets by the hour or the piece. If we are to treat them as cadets, let it be understood by the method of pay that we are not expecting them to earn the hourly wage, but that we are expecting them to do far more—prepare themselves quickly for higher duties, irrespective of the hours in the twenty-four to be devoted to the present task. Paying these men by the hour or piece implies that they are expected to earn the wages so scheduled by the product of their labor. To me this is essentially wrong. We should not expect them to produce on a par with the mechanic who is paid by the hour or piece and is expected so to make good day by day and year after year.

I am glad to see that I. I. W. appreciates that it is up to the engineer graduates to get down to hard and, if necessary, dirty work. The man who thinks that his college diploma is to save him from any or all necessary practical experiences, should not attempt to qualify himself in our profession. Perhaps we might go farther and say that to qualify in any profession or vocation, he must first discard such a puerile conception of life's work.

Certainly the railroads and other employers are making an unnecessary loss for themselves if they go to the expense of establishing an apprenticeship system for engineer graduates, and then do not secure a fitting return through the retention in their service of men thoroughly trained in the science and practice of engineering.

As is pointed out in the editorial referred to, there is an advantage in letting the student before graduation specialize for the line which he expects to follow. But there are disadvantages, and the plan is all too likely to be over-developed. The engineer undergraduate student of good average ability has no easy task if he covers the fundamentals of engineering science in the standard four-year college course. The sub-divided specializing should not be much more than an emphasis on some one branch. For instance, at Stevens, although our sub-title is "A School of Mechanical Engineering," we do not closely specialize in the mechanical branch of our profession and, as a result, our graduates are found to be active and prominent in every branch of engineering. But they have one advantage—they are constantly being instructed to the effect that their college training must be supplemented, chiefly through their own studies, for which they have been trained, in some one of the departments of the school of experience.

And here is where there should be a more complete and intelligent co-operation between the colleges and the employers. The former should be frank to point out to their students that the college studies, no matter how complete and how practical, are not sufficient for efficient practice in engineering and the industries; and the employers should not at the first expect too much of the young graduate, but should give him the best possible opportunities to acquire the additional practical training in the school of experience.

The value of the co-operative scheme of education is well shown in the work of the Glasgow University, and in that of our Cincinnati University.

I am free to confess that if I. I. W. has correctly described the apprenticeship instruction for engineer graduates as practiced by some of our railroads, I should, if consulted, advise a young man of ability not to engage therein. And this I say, notwithstanding the fact that I have given ample proof through years of practice that I would not hire an engineer graduate who was not willing to be a hard-working, conscientious, persistent student in the school of experience. And let me add that studies in this school should cease only with his retirement from active duties.

It is for the colleges, the employers and the engineer graduates to appreciate that there is room for improvement. Some of the colleges and railroads are much at fault; no doubt all of each are partly at fault. We cannot expect the youngsters to do their best unless we first do our best to give them the most complete opportunities to qualify for advancement; provided, of course, that they are willing to do their best to qualify.

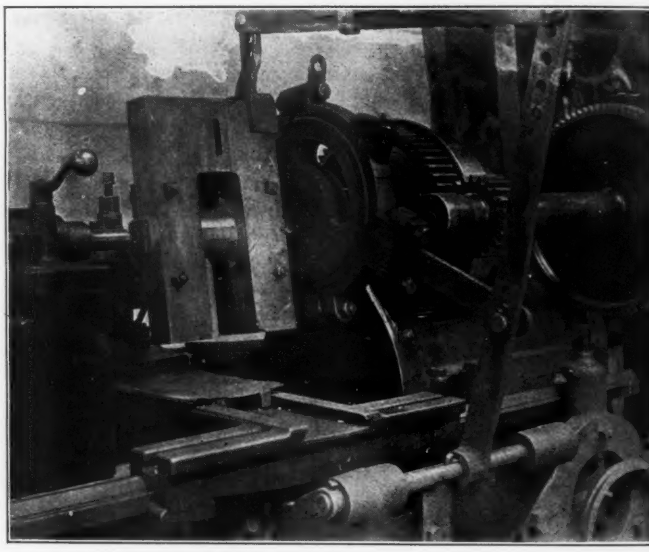
ALEX. C. HUMPHREYS,
President of Stevens Institute of Technology.

TURNING FOUR-BAR CROSSHEAD WRIST PINS

St. Paul, Minn., October 6, 1913.

To the Editor:

In the April, 1913, number of the *American Engineer*, page 192, is shown an arrangement for turning a four-bar guide crosshead wrist pin. We have an attachment on one of our lathes in the Chicago, St. Paul, Minneapolis & Omaha shops which I believe to be original, and it is positive in its operation. It is shown in the illustration. An eccentric is screwed to the headstock of the lathe which, together with the levers, gives the crosshead the necessary oscillation; the lathe runs as in any other work. In the one in use here the eccentric has a travel of 8 in., the rest of the apparatus being made to suit the lathe. Our practice is to plane the top and bottom of the pin to size and slot it front and back; we then turn the pin a quarter of a revolution at a time.



Apparatus for Turning the Wrist Pins of Four-Bar Crossheads.

I have not shown the tools used, which, although they are not exactly the same as those shown in the April number, are similar and could be used in the same way.

JAS. FINDLAY,
Foreman, Construction Shop.

New Alloy of Platinum.—A new hard alloy of platinum is said to have been produced by the addition of osmium. It is claimed that this alloy, which contains from 0.5 to 1.0 per cent. of osmium, has physical and electrical properties fully equal to the platinum alloy containing a much higher percentage of iridium.—*The Mechanical Engineer.*

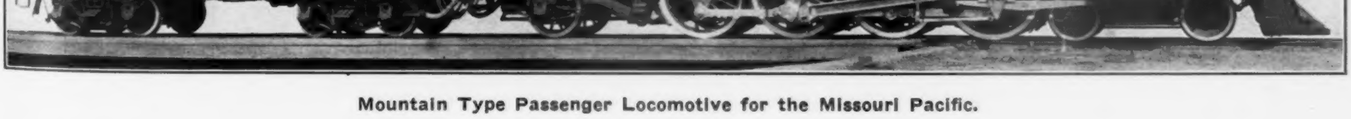
Record-Breaking Monoplane Flight.—At Rheims, France, September 29, Maurice Prevost, flying over a circular course, in a monoplane, traversed a distance of 124.28 miles in 59 minutes, 45.6 seconds, or at the rate of 124.58 miles an hour. The length of the circular course is 6.213 miles, and Prevost made one circuit in 2 minutes 56.6 seconds.

4-8-2 Type for Missouri Pacific

New Powerful Passenger Locomotives Take Trains Weighing 820 Tons Over 1.9 Per Cent. Grades.

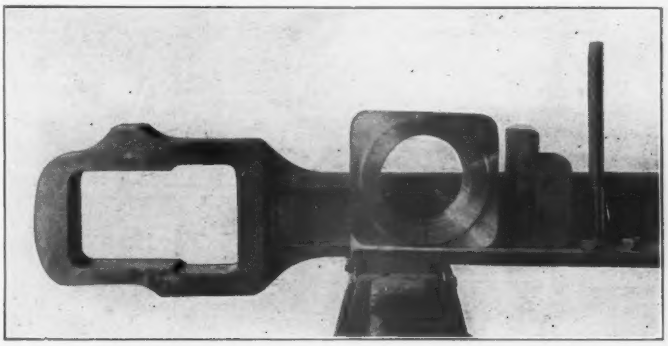
On the Missouri division of the Missouri Pacific, which extends from St. Louis to Poplar Bluff, Mo., a distance of 165 miles, there are a number of heavy grades of moderate length. The steepest is 1.9 per cent., 5 miles long and includes 5 deg. uncompensated curves. There are several others of greater length that have a rise of from 1 per cent. to 1.5 per cent. The passenger traffic on this division is very heavy, and up to recently Pacific type locomotives have been used exclusively. These engines have a tractive effort of 36,800 lbs., and when the traffic required trains of more than 8 cars it has been necessary to use two locomotives. As double heading became more or less frequent, it was decided to obtain larger locomotives, and the problem was presented to the American Locomotive Company, which prepared a design of 4-8-2 type locomotive as suited for this service. Seven of these engines have recently been completed and it is found that they are able to handle trains of from 12 to 14 cars, having a weight of 820 tons, over the 1.9 per cent. grade, at a speed of 18 miles an hour. This is from 50 to 75 per cent. heavier train than it was possible to haul with one locomotive previously.

A weight limit of 210,000 lbs. on drivers was specified. This necessitated a carefully designed boiler to obtain the maximum power without exceeding the limit of weight. It was decided to use a steam pressure of 170 lbs., and a boiler of the conical type having an inside diameter of 74¼ in. at the front end and an outside diameter at the largest course of 87½ in., and a grate area of 56.5 sq. ft. was adopted. This boiler would not allow the application of cylinders larger than 28 in. x 28 in., and in order to obtain the desired tractive effort to handle 14-car trains, the driving wheel diameter was reduced to 63 in. In view of the class of traffic and conditions of service this combination was thoroughly satisfactory. These engines are not intended for sustained high speed such as would ordinarily be demanded of a large Pacific type, and this size of wheel allows them to go up the steep grades at sufficiently high speed and also is large enough to obtain the necessary speed when they are descending grades where boiler capacity does not become a factor.



Mountain Type Passenger Locomotive for the Missouri Pacific.

Comparing them with the Chesapeake & Ohio mountain type locomotives, it will be seen that the Missouri Pacific engines are distinctly smaller, particularly in connection with the boiler. This is due principally to the weight limitations which allowed a boiler of exceptional power to be applied on the Chesapeake & Ohio design. When the boiler is compared with that on the Pacific type locomotives which they displace, it will be found that outside of the introduction of the combustion chamber, an increase in the grate area of about 14 per cent. and the reduction of the steam pressure from 180 to 170 lbs., there is very little difference in the size. The combustion chamber adds 51 sq. ft. to the heating surface of the firebox, but the heating surface of the tubes and flues has been reduced by 56 sq. ft. If it is assumed that the heating surface in the firebox is six times as valuable as that in the tubes, and that the heating surface of the arch tubes is ten times as valuable as that in the boiler tubes, it will be found that on the basis of heating surface, the mountain type boiler is about 5 per cent. larger than that used on the Pacific type. This, taken in connection with a 14 per cent. increase in the grate area and a reduction of 10 lbs. per square inch in the steam pressure, will give a considerable net increase in this boiler. The size of the superheater is about the same in both locomotives.



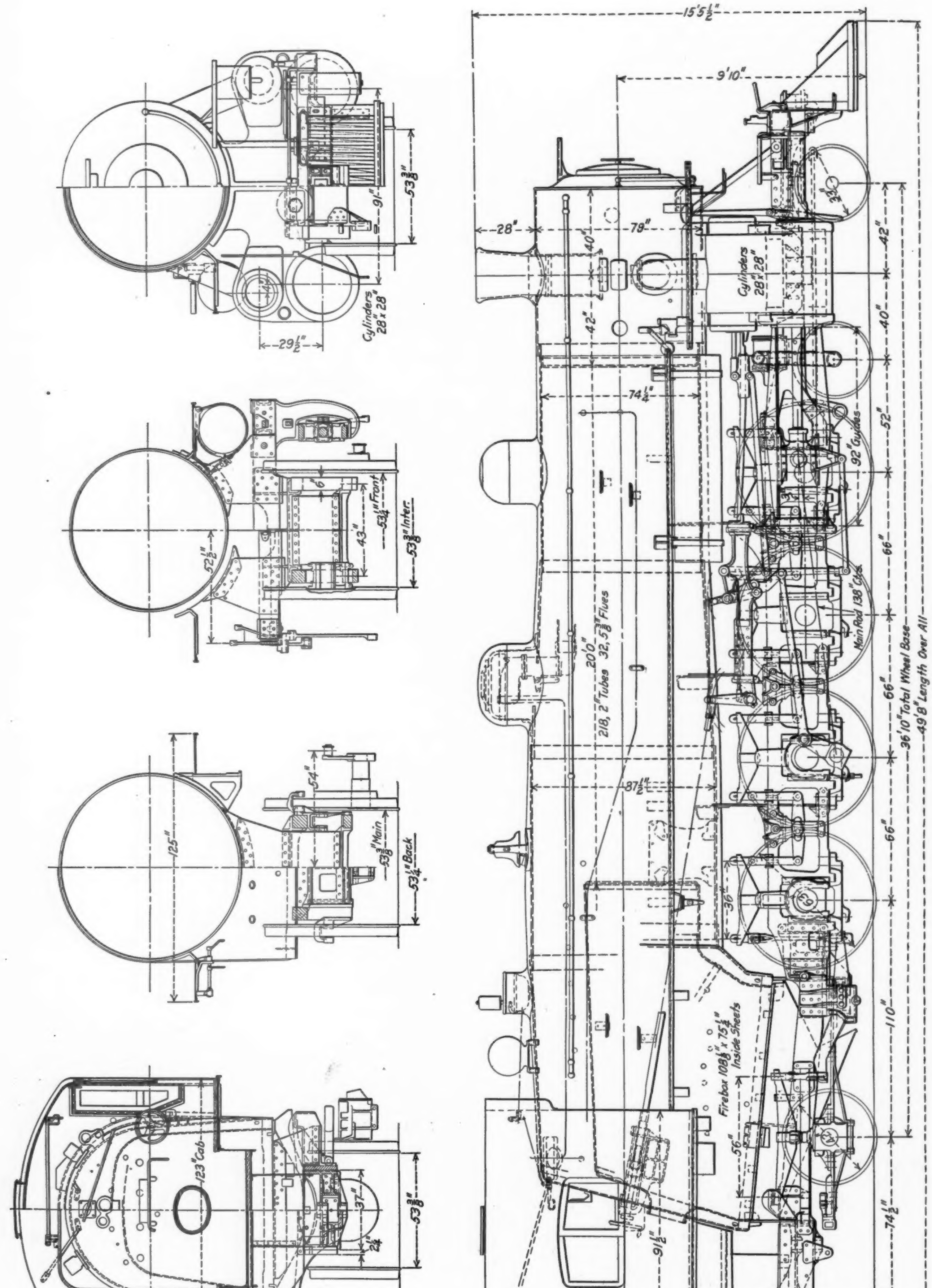
New Type of Main Rod End and Brass.

The design throughout embodies the latest improved practice of the builders. The engines have a screw reverse gear; outside steam pipes; extended piston rods; latest improved, outside bearing trailer trucks and Baker valve gear. A new design of solid end main rod has been employed, with the result of a saving of about 115 lbs. in weight per rod as compared with the forked end rod. This rod, which is of the Foulder design, uses the same pattern of brass both at the front and the back of the pin and two adjustable wedges are employed for obtaining the desired adjustment.

The general dimensions, weights and ratios are shown in the following table:

General Data.

Gage	4 ft. 8½ in.
Service	Passenger
Fuel	Bit. coal



Mountain Type Passenger Locomotive for the Missouri Pacific.

Tractive effort	50,400 lbs.
Weight in working order	296,000 lbs.
Weight on drivers	208,000 lbs.
Weight on leading truck	48,000 lbs.
Weight on trailing truck	40,000 lbs.
Weight of engine and tender in working order	457,500 lbs.
Wheel base, driving	16 ft. 6 in.
Wheel base, total	36 ft. 5 in.
Wheel base, engine and tender	70 ft.

Ratios.

Weight on drivers ÷ tractive effort	4.14
Total weight ÷ tractive effort	5.87
Tractive effort × diam. drivers ÷ heating surface*	692.00
Evaporating heating surface ÷ grate area	61.00
Firebox heating surface ÷ tube and flue heating surface, per cent	9.00
Weight on drivers ÷ heating surface*	45.40
Total weight ÷ heating surface*	64.80
Volume both cylinders, cu. ft	20.00
Heating surface* ÷ vol. cylinders	229.60
Grate area ÷ vol. cylinders	2.83

Cylinders.

Kind	Simple
Diameter and stroke	28 in. x 28 in.

Valves.

Kind	Piston
Diameter	14 in.
Greatest travel	6½ in.
Outside lap	1 in.
Inside clearance	0 in.
Lead	3/16 in.

Wheels.

Driving, diameter over tires	63 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	11 in. x 12 in.
Driving journals, others, diameter and length	10 in. x 12 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	6 in. x 12 in.
Trailing truck wheels, diameter	42 in.
Trailing truck, journals	8 in. x 14 in.

Boiler.

Style	Conical
Steam pressure	170 lbs.
Outside diameter of first ring	75¾ in.
Firebox, length and width	108⅛ in. x 75¼ in.
Firebox plates, thickness	⅜ in. and ⅝ in.
Firebox, water space	4½ in.
Tubes, number and outside diameter	218—2 in.
Tubes, material and thickness	Spellerized steel, No. 11 B. W. G.
Flues, number and diameter	32—5⅜ in.
Flues, material and thickness	Seamless steel, No. 9 B. W. G.
Tubes and flues, length	20 ft.
Heating surface, tubes and flues	3,165.2 sq. ft.
Heating surface, firebox	285.5 sq. ft.
Heating surface, total	3,450.7 sq. ft.
Superheater heating surface	761 sq. ft.
Grate area	56.5 sq. ft.
Smokestack, diameter	18 in.
Smokestack, height above rail	15 ft. 5½ in.

Tender.

Frame	Cast steel
Wheels, diameter	33 in.
Journals, diameter and length	6 in. x 11 in.
Water capacity	8,000 gals.
Coal capacity	14 tons

*Equivalent heating surface equals evaporating surface (3,450.7 sq. ft.) plus 1.5 times superheating surface (761 sq. ft.), or 4,592.2 sq. ft.

ENGINE HOUSE SMOKE.—Several years ago we endeavored to collect the smoke and gases by means of suction fans and pass them through water sprays to precipitate the heavier contents, but without success. The size, first cost and operation cost prohibited a plant of sufficient capacity. A modification of this arrangement, in which the smoke and gases are forced through a considerable body of water, is about to be put in operation, and I am sure it will be watched with interest by all concerned in this subject. At the present time the Pennsylvania Lines have under construction, at the engine house in Allegheny, apparatus to carry the smoke and gases from the locomotives in which fires are being prepared, through an underground duct and a fan, discharging them into a stack 150 ft. high, and 7 ft. in diameter. It is felt that this arrangement will not only carry the smoke and gases considerably above the buildings immediately adjacent to the engine house, but, owing to the size of the stack, permit of considerable precipitation of the heavier particles. The stack will be so located that it will be possible to interpose smoke washing apparatus between it and the fan, should a sufficiently promising method be developed.—*D. F. Crawford before the International Society for the Prevention of Smoke.*

DESIGN OF LOCOMOTIVE GRATES

BY W. R. HEDEMAN

Probably the first parts of a new locomotive to need replacement are the grates, due to the heat to which they are subjected, and anything that will tend to improve and prolong their life should be gladly received by motive power men. It is the hope of the writer that the information contained in this article will be beneficial to those who are seeking to better the grate design and arrangement.

There must be enough opening in the grates to permit all the air coming through the damper openings to pass through, in

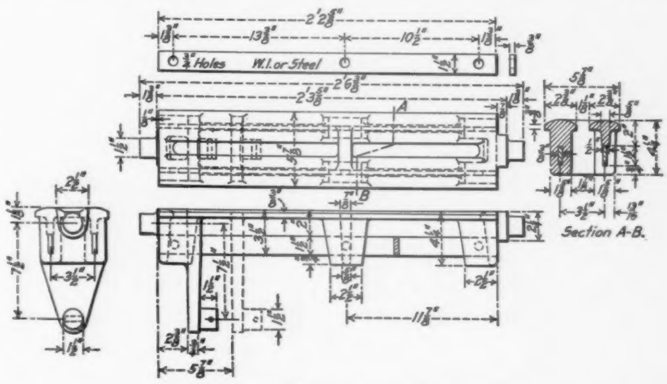


Fig. 1—Table Grate Bar.

order to produce proper combustion; one square foot of damper opening to seven square feet of grate area is a good standard toward which to work. Fig. 1 shows a table grate bar with reinforcing strips of wrought iron or steel cast in it. This is an excellent bar, but is more expensive than one made entirely of cast iron. Owing to the narrowness of this type of grate a front and back dump grate are necessary. Fig. 2 shows a finger grate bar reinforced with wrought iron. This type of bar has been used very extensively and is especially good in breaking up the fire where lumpy coal is used. It must be kept level, as the fingers will burn off if allowed to extend up into the fire.

With the foregoing types of grates dump grates are necessary,

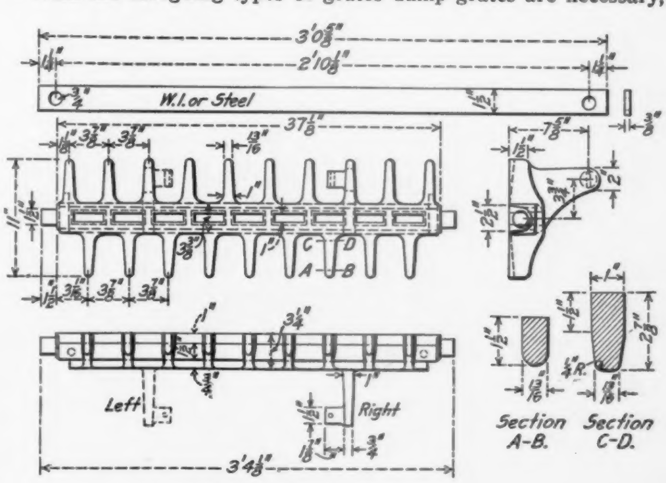


Fig. 2—Finger Grate Bar.

and Fig. 3 shows a design of such a grate which is giving good service. This is also reinforced with wrought iron, which adds considerable to the life of both the grate bar and the dump grate. Any scrap of about the section shown in Fig. 3 (½ in. x 2 in.) may be used for these strips; old boiler plates 5/16 in. to ½ in. in thickness may be cut up and straightened for the purpose. The strips should be heated before being used, to prevent moisture collecting.

A very serviceable locking arrangement for dump grates is

shown in Fig. 4. The keeper or latch is secured to the backhead or cab sheet, and engages over the end of the dump lever which is especially arranged for it.

A bar that is giving good service and one to be recommended, especially where mechanical stokers are used and a fine coal is necessary, is shown in Fig. 5. The ends of the shaking arms are placed 2 in. off center, which permits the tilting of the grates to such an angle as to provide an opening between them large enough for all clinkers to fall through, thus doing away with dump grates and stationary corner grates.

A cast steel center bearing bar is shown in Fig. 6. This de-

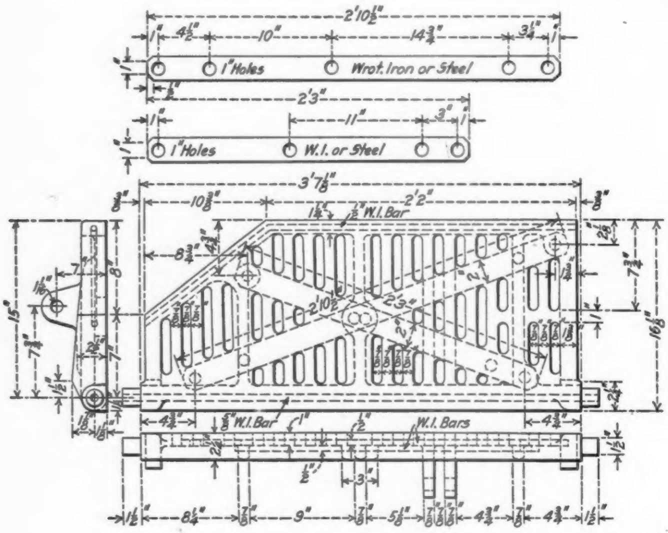


Fig. 3—Back Drop Grate.

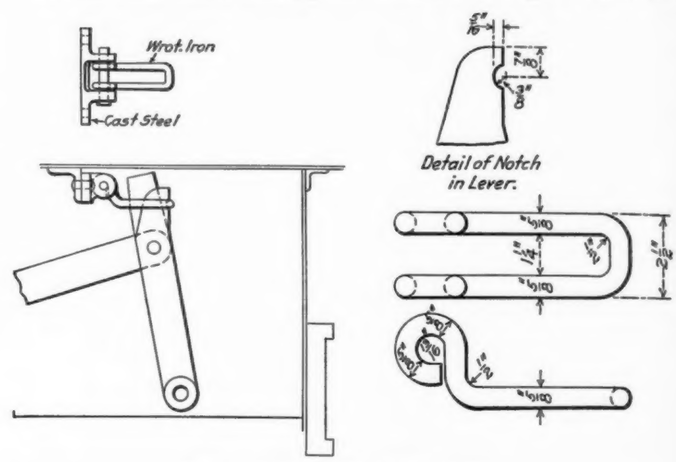


Fig. 4—Drop Grate Lever Keeper.

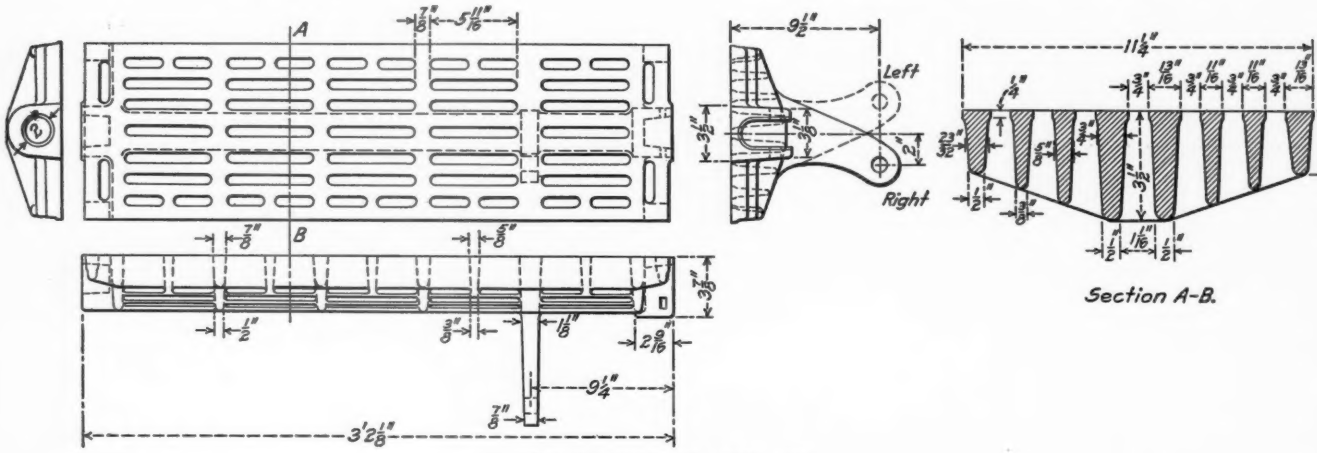


Fig. 5—Box Type Grate Bar.

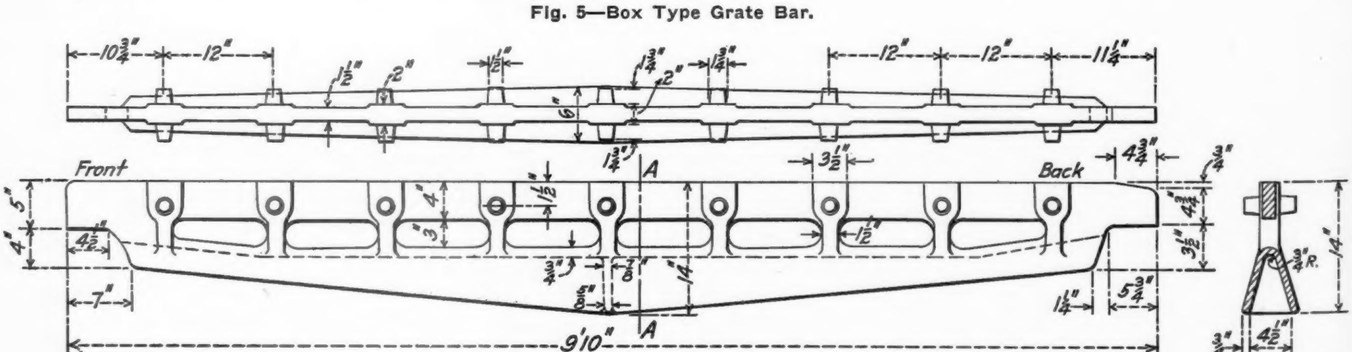


Fig. 6—Grate Center Bearing Bar.

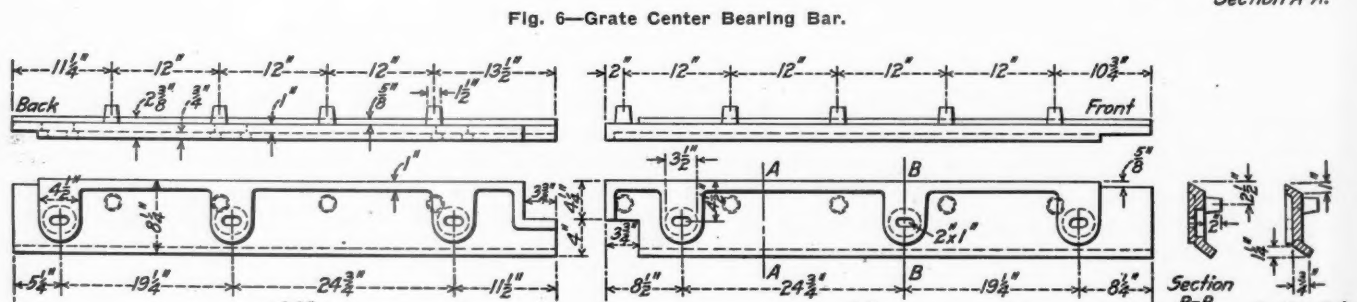


Fig. 7—Grate Side Bearing Bars.

sign gives good service and causes practically no trouble. The trunnion bearing bar has been adopted because it will not hold

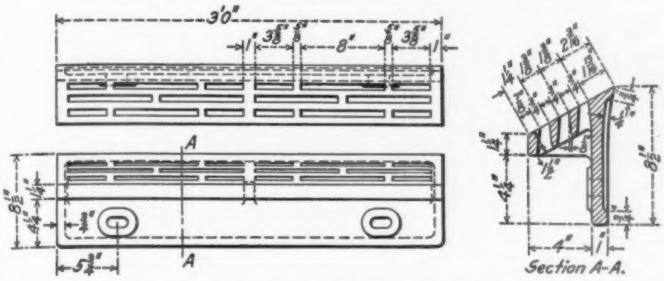


Fig. 8—Front Dead Grate of the Box Type.

the ashes, as in the old type, and permits the grates to be more easily shaken.

Cast steel side bearing bars of an approved design are shown

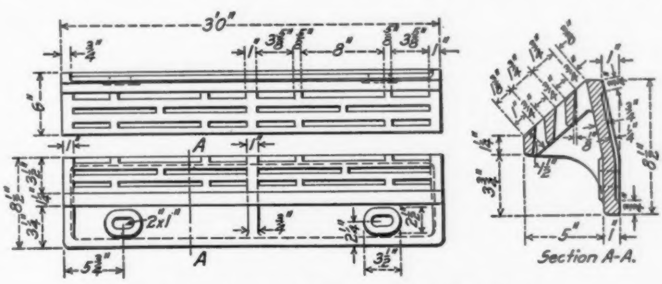


Fig. 9—Back Dead Grate of the Box Type.

in Fig. 7. The top beveled edge of this bar fits snugly against the side sheet, thus preventing hot ashes from falling down and lodging against the sheet and burning it. There is also a cored depression for the clamping nut which prevents any ashes accumulating on top of the nut. It has been found better to make the side bars in two pieces, rather than a long one piece bar, so as to obtain castings which are not warped.

Figs. 8 and 9 show a box type of front and back dead grate designed to shed the ashes to the shaking grates, and Fig. 10 shows the method of fastening the side bearing bars to the firebox sheets. The rivet stud is driven into one of the mudring rivet holes and serves a double purpose, that of a rivet and a

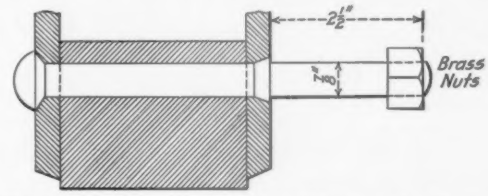


Fig. 10—Method of Fastening Side Bars in Place.

stud. Brass nuts are best for use on these studs, as there is then no corrosion and the nuts are easily removable.

As most modern locomotives have wide fireboxes, two and sometimes three sections of grates are necessary. Fig. 11 shows a two section arrangement of grates made up from the box grates illustrated in this article. This arrangement is being used on large Mikado type locomotives equipped with Street stokers, and is giving excellent service. With this design care must be taken to give the shaking lever full movement in the cab. The bars should tilt until the edges strike against the grouping rods on the arms of the bars. It has been found from experience that the box type of bar shown in this ar-

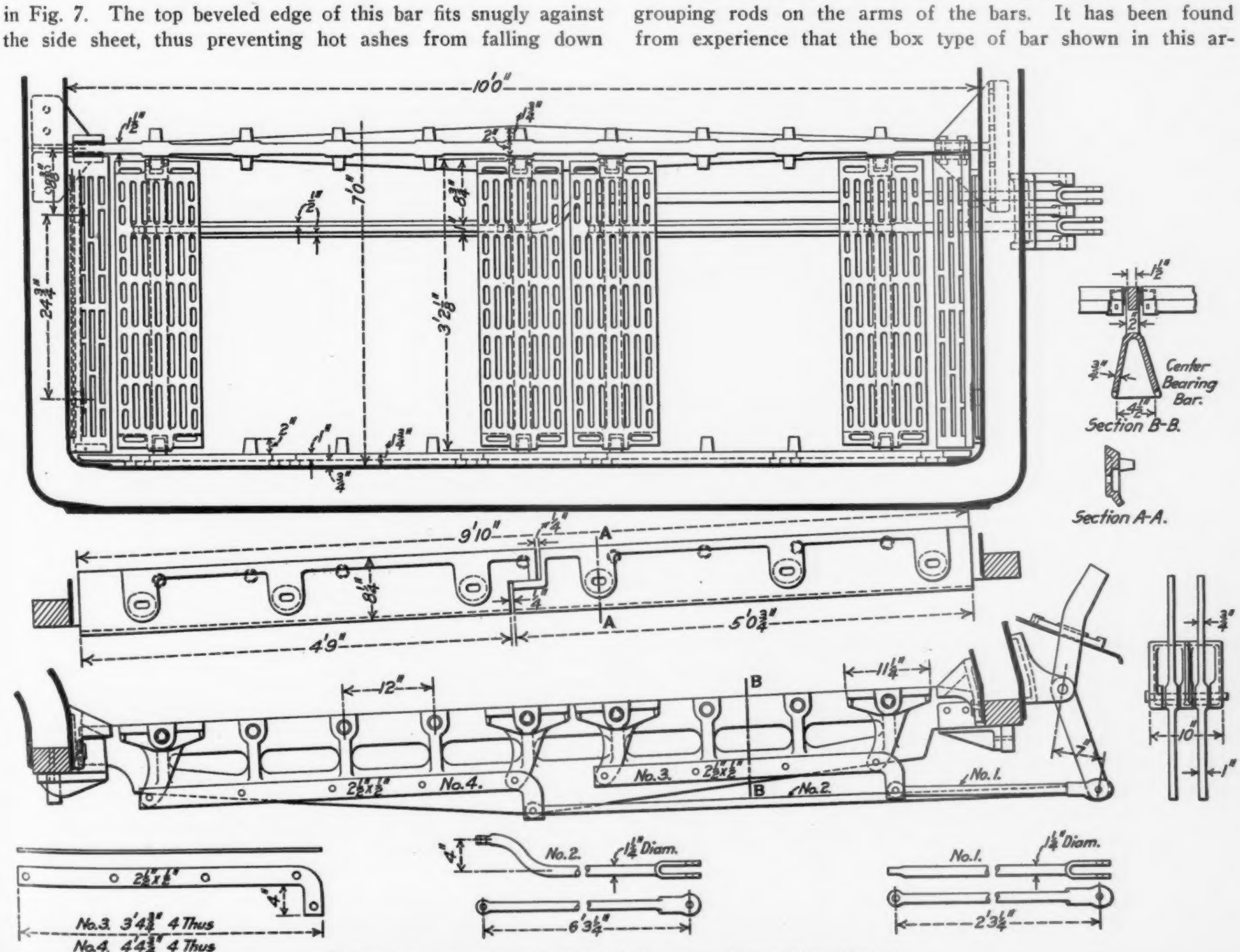


Fig. 11—Arrangement of the Grates in a Locomotive Firebox.

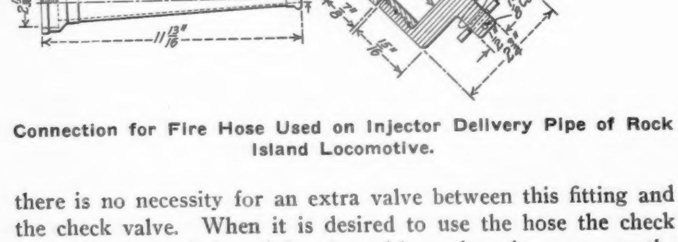
rangement is the most satisfactory and has the longest life, and it also relieves the foundry of considerable output as compared with other types of bars. While this type was primarily adopted on account of the fine coal used with the Street stoker, its use has been extended to other locomotives using lump coal, with excellent results. With the use of a Tabor molding machine the molds for this grate can be made for 15 cents each. It will be noted by referring to Fig. 5 that the shaking arms are of such construction as to permit the cleaning of the grates in the rattler after they are cast.

RESULT OF LETTER BALLOT OF THE M. M. ASSOCIATION

Thirty-seven proposed changes in the recommended practice of the American Railway Master Mechanics' Association were submitted to the members for letter ballot. All of them were adopted. In addition to many which were adopted practically in conjunction with the Master Car Builders' Association there have been changes or complete revisions made in the specifications for locomotive frames, for steel tires, for boiler tubes, for solid wrought carbon steel wheels as well as a new formula for main and side rod design. The designs proposed for solid wrought carbon steel wheels were adopted as well as the other recommendations of the committee on engine and tender wheels which are given on page 1381 of the *Daily Railway Age Gazette*.

LOCOMOTIVE FIRE EXTINGUISHER

At the recent convention of the Railway Fire Protection Association, P. Hevener, assistant supervisor of insurance fund of the Rock Island lines, described the fire extinguishing equipment used on 250 switching locomotives on that system. The injector delivery pipes on both sides of these locomotives have a Y-connection, as is shown in the accompanying illustration. Under the running board in a closed box there is a 50-ft. 2 in. unlined linen fire hose with couplings and nozzles. As the Rock Island engines are equipped with combined stop and check valves



Connection for Fire Hose Used on Injector Delivery Pipe of Rock Island Locomotive.

there is no necessity for an extra valve between this fitting and the check valve. When it is desired to use the hose the check valve is clamped in a closed position, the pipe cap on the end of the exposed leg of the Y is removed and the hose coupled on, the water being forced through the hose by the injector in the same manner as when feeding the boiler. Although this heats the water to a considerable extent, it is not hot enough to scald, and by the use of gloves the nozzle may be easily handled. This equipment costs about $45, and has given most satisfactory results, saving several thousand dollars worth of property from fire damage since it has been in use on the Rock Island lines.

LOCOMOTIVE HEADLIGHT LAWS

In its report to the convention of the Association of Railway Electrical Engineers, the committee on locomotive headlights gave a summary of the headlight laws in the various states which are reproduced below.

The committee, in considering this summary, expressed the opinion that these laws were drawn without due consideration of the suitable standard condition or basis under which tests could be made and reproduced, and it recommended that the association express its sentiment as being unfavorable to the enactment of any law or laws which do not clearly specify a standard national basis under which tests may be made. It further recommended that the standard specifications be so drawn as not to eliminate apparatus which may be invented or designed in the future. It is the opinion of the committee that the quantity and quality of illumination at some specific point is the prime object of the headlight and not the means or apparatus by which this illumination may be effected or obtained.

The summary presented is as follows:

ELECTRIC.

(1) Headlight of 1,500 candle power, measured without reflector: Arizona.
(2) Headlight of 1,500 candle power, measured with reflector: Missouri (effective January 1, 1914).
(3) Headlight consuming 300 watts at the arc: Georgia (23 in. reflector required). Mississippi (18 in. reflector required).
(4) Headlight sufficient to distinguish an object the size of a man at 800 ft., measured with reflector: Oregon (effective February 21, 1914).
(5) Headlight of design approved by Railway or Public Service Commission: Vermont. Washington.

NOT NECESSARILY ELECTRIC.

(6) Headlight of 1,200 candle power, measured without reflector: Colorado (effective April 3, 1914). North Dakota (effective July 1, 1914).
(7) Headlight of 1,500 candle power, measured without reflector: Minnesota (effective January 1, 1914). Montana. Nevada (effective January 1, 1914). North Carolina. Oklahoma. South Dakota. Texas.
(8) Headlight of 1,500 candle power: Arkansas. Florida (effective October 1, 1913). Indiana.
(9) Headlight of 10,000 candle power, measured with reflector, or sufficient to distinguish an object the size of a man at a distance of 800 ft.: South Carolina.
(10) Headlight sufficient to enable operator to distinguish an object the size of a man lying prone on track at a distance of 1,100 ft.: Iowa (10 per cent. by October 2, 1913; 10 per cent. each 30 days thereafter).
(11) Headlight sufficient to distinguish a dark object the size of a man at a distance of 800 ft. while train is running not less than 30 miles an hour: California (effective August 11, 1913).
(12) Headlight sufficient to distinguish an object the size of a man at a distance of 800 ft.: Illinois (passenger train locomotives only; effective July 1, 1913). Kansas. Wisconsin.
(13) Headlight sufficient to distinguish an object the size of a man at 600 ft. by a person of normal vision: Nebraska (effective January 1, 1914).
(14) Headlight sufficient to distinguish an object the size of a man at a distance of 450 ft.: Illinois (freight train locomotives only; effective July 1, 1913).
(15) Headlight sufficient to distinguish whistling posts, land marks and other warning signs at a distance of 350 ft.: Michigan (30 per cent. by March 1, 1914; all locomotives by July 1, 1914). Ohio.
(16) Headlight sufficient to distinguish an object the size of a man at a distance of 250 ft.: Illinois (switching, transfer or suburban passenger service only; effective July 1, 1913).
(17) Headlight of 50 candle power, measured without reflector: Minnesota (switching locomotives only; effective January 1, 1914).

The penalties for violation of these laws vary from a minimum of $25.00 to a maximum of $1,000.00 each offense.

Attention is directed to the wide difference in the provisions of these Acts. These differences render it impossible in all cases for railways operating in more than one state to make use of appliances standard in one state in others through which they run. There is no Federal legislation on this subject, but bills are pending in the present Congress.

COAL MINE FATALITIES.—The total fatalities during the first seven months of 1913 in the coal mines of the United States were 1,437 as compared with 1,419 for the same period in 1912.

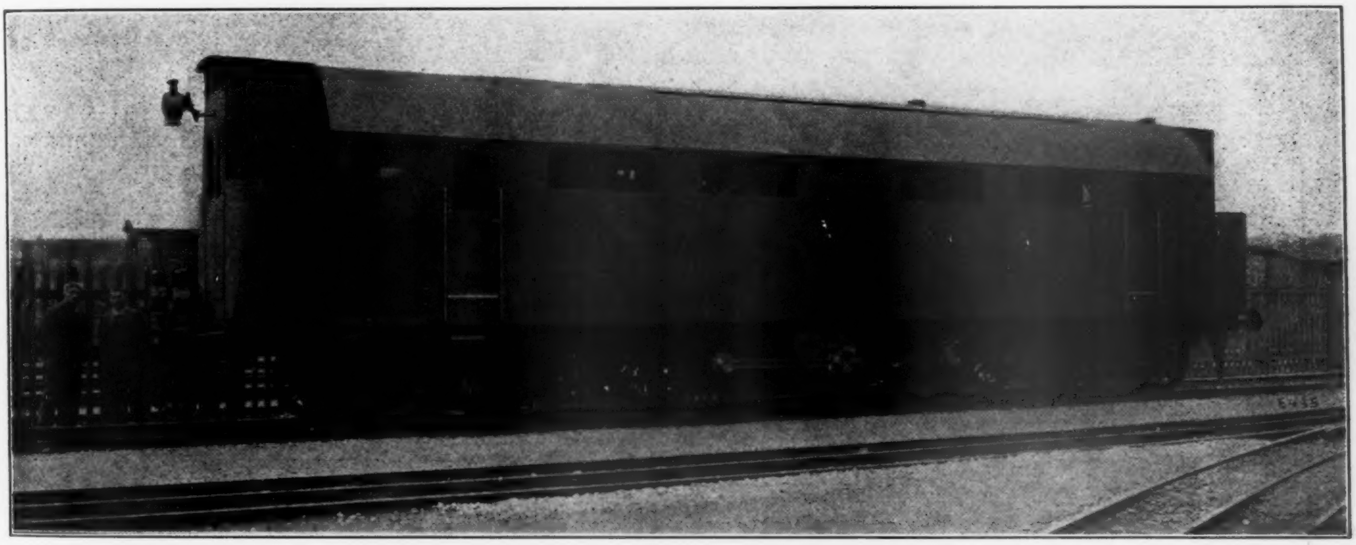
SULZER-DIESEL LOCOMOTIVE

4-4-4 Type Driven by a Direct Connected Oil Engine; Built for Prussian-Hessian State Railway.

During the past three or four years there has been a continually increasing interest taken in the possibilities of the Diesel oil engine for all classes of work where economy of fuel is desired. It is not only now being employed for stationery plants driving electric generators and other classes of machinery, but has also been adapted to marine use with decided success. There are now between 300 and 400 ships driven by Diesel engines, some of them being of large size.

Its success in these fields has naturally led to a consideration of its possibilities for use on a locomotive, and while the problems here were considerably more difficult of solution, a moderate sized locomotive, successful, at least so far as its operation is concerned, has recently been completed at the works of Sulzer Bros., Winterthur, Switzerland, for the Prussian-Hessian State Railway.

This locomotive is intended for high speed passenger service and the trials already made show it capable of attaining a speed of at least 62 miles an hour. The reports do not give the weight of the train which it hauled at any speed. It is of the 4-4-4 type, has a total length of 54 ft. 5 in. and a total weight of 190,000 lbs. The driving wheels have a diameter of about 69 in. The driving wheel base is 11 ft. 8 in., leaving space between the drivers for a jack shaft, which carries a large disc on either end that includes the crank pin for the connection of the rods that drive the wheels through crank pins in the ordinary manner; this disc is counterbalanced. The four-cylinder oil engine is connected directly to this shaft, giving a direct drive to the wheels without the introduction of gears or clutches of any kind. The cab is continuous for the full length of the locomotive and has side and end doors arranged as is shown in the illustration.



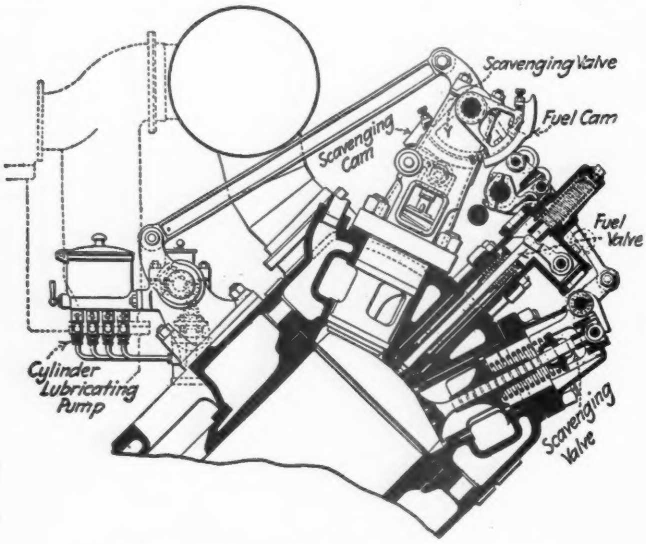
Sulzer-Diesel Locomotive for the Prussian-Hessian State Railway.

A Diesel engine, so far as heat efficiency is concerned, is the most economical machine known, having a thermal efficiency of 48 per cent. and frequently an effective efficiency of nearly 35 per cent. It is generally arranged for use with oil fuel and develops power from the fuel directly in the cylinder without any previous transformatory process. It is distinctly an internal combustion engine, as distinguished from other gas and oil engines which are, strictly speaking, internal explosion engines. Like other gas engines, it is built in both the four-cycle and two-cycle designs, and it is the latter type that is used on this locomotive. In this type the general action of the engine is as follows: Consider the piston at the bottom end of its stroke; the cylinder is then full of air at nearly atmospheric pressure, and this is compressed during the first or upward stroke of the piston to a pressure of 500 lbs. or more per square inch while the temperature rises to between 1,000 degs. and 1,100 degs. F. During the early portion of the downward stroke the fuel oil is injected in the cylinder above the piston by a blast of air at a higher pressure than that in the cylinders, through a special form of needle valve. Combustion takes place during this period as the temperature of the compressed air in the cylinder is above the burning point of the oil fuel. The duration of this part of the stroke depends on the position of the fuel valve, but cut-off usually occurs not later than 1/10 of the stroke at full load. At the cut-off when the fuel inlet valve closes, combustion continues for a short period, expansion then occurs and work is done on the piston through about another 75 per cent. of its stroke, at which point the exhaust opens and the products of combustion begin to pass out. Air under a pressure of about 20 lbs. per square inch then enters through a separate valve or port in the cylinder head, being supplied from a scavenger pump, and the exhaust gases are all forced out through the exhaust ports in the sides of the cylinder, which are opened by the piston at the lower end of its stroke. This leaves the cylinder full of pure air at the beginning of the next stroke and the cycle is repeated.

Since in the case of the locomotive the engine is direct connected to the driving wheels through the side rods, it is necessary for it to attain a certain speed before it can start working on oil fuel. This is done by means of compressed air obtained from an auxiliary compressor set, consisting of a 250-horse power Diesel engine driving a horizontal three-phase air compressor, which furnishes air between 700 lbs. and 1,000 lbs. pressure. Reservoirs are provided for storing the excess air and for providing a pressure for starting the main or compressor engines. It has been found necessary to use the compressed air until the locomotive attains a speed of five or six miles an hour, at which point the liquid fuel is turned on and the engines work as a power producer.

The four cylinders of the main engine are arranged in pairs,

each inclined 45 degs. to a line perpendicular to the rail, their axes intersecting in that of the single crank shaft, common to all. They have a diameter of 15 in. and a stroke of about 21⅝ in. Each pair of cylinders lies in a common plane and acts on a common crank pin. The two cranks are set at 180 degs. and at 60 miles an hour make slightly over 300 revolutions a minute. Each of the four cylinders carries in its head a fuel valve, a starting valve and two scavenger valves. Between the crank pins there are two eccentrics each controlling all the valves on one-half of the main engine. These eccentrics are rotatable for reversing the running direction; this is accomplished through a special system of links and rods that are operated from the driver's compartment. In connection with the eccentrics there

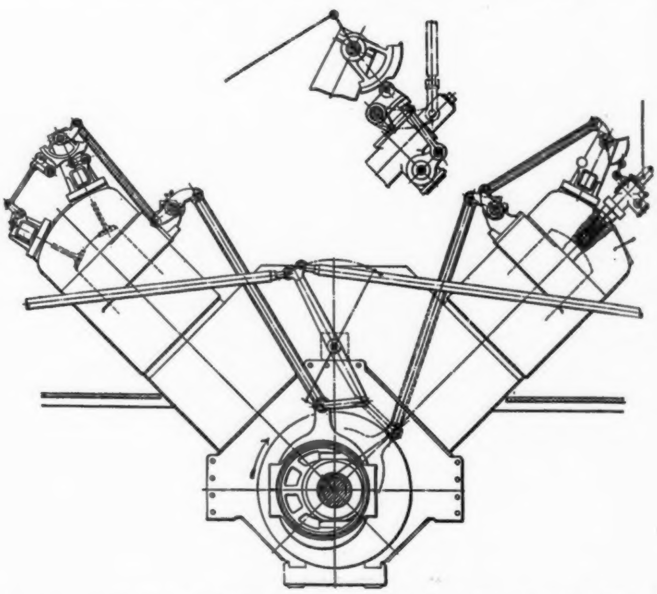


Valves in the Head of the Main Engines.

is a rather complicated system of links, cams and small eccentric shafts for controlling the opening and closing of the various valves in the cylinder head as well as the variation in the time the fuel inlet valves are opened for controlling the speed of the locomotive.

There are two double acting piston pumps as well as a three-stage air injecting pump located between the main engine cylinders and driven through the medium of rocker arms and links from the connecting rods of two of the cylinders. These pumps are all fitted with relief valves.

The auxiliary Diesel engine is also a two-cycle machine of 250 horse power. It has two vertical cylinders, 12 in. in diameter, with 15 in. stroke, fed by a duplex fuel pump. The crank shaft has two counterbalanced fly wheels and its two cranks are 180 degs. apart, and operate through other connecting rods, two horizontal multi-stage air pumps. There is a distributing valve which controls the delivery of these compressors between zero and the maximum and a governor controls the speed of the engine.

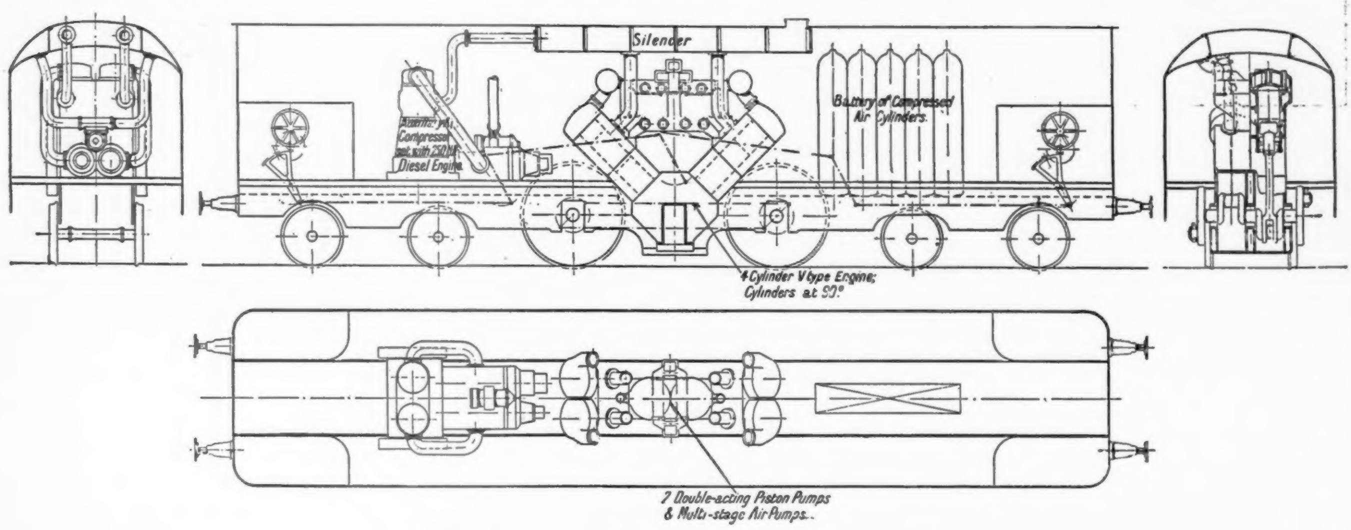


Arrangement of the Cylinders and Reversing Gear of the Diesel Engine.

When the locomotive is stopped or under service requiring but little air the compressor delivers its surplus to receivers placed behind the main engine. Special pumps are provided for lubrication and there are hand-operated centrifugal pumps included on the locomotive for priming the cold water, circulating water and the fuel piping when needed.

A Westinghouse brake equipment is used, there being shoes on all of the wheels. The air for braking is taken from an intermediate stage of the compressor and stored in a special reservoir.

The organization formed to build this locomotive, and probably to also control the construction of future locomotives of the same type, is called the Thermo Locomotive Company. In this are associated the firm of Sulzer Brothers, Oberbaurat A. Klose of Berlin and Dr. Diesel of Munich. The headquarters of the Thermo Locomotive Company are at Ludwidshafen. All of the patents on the new locomotive, however, are owned by Sulzer Brothers. The running gear on the locomotive was built by A. Borsig of Berlin.



General Arrangement of the Sulzer-Diesel Locomotive.

CUMBERLAND TERMINAL OF THE B. & O.

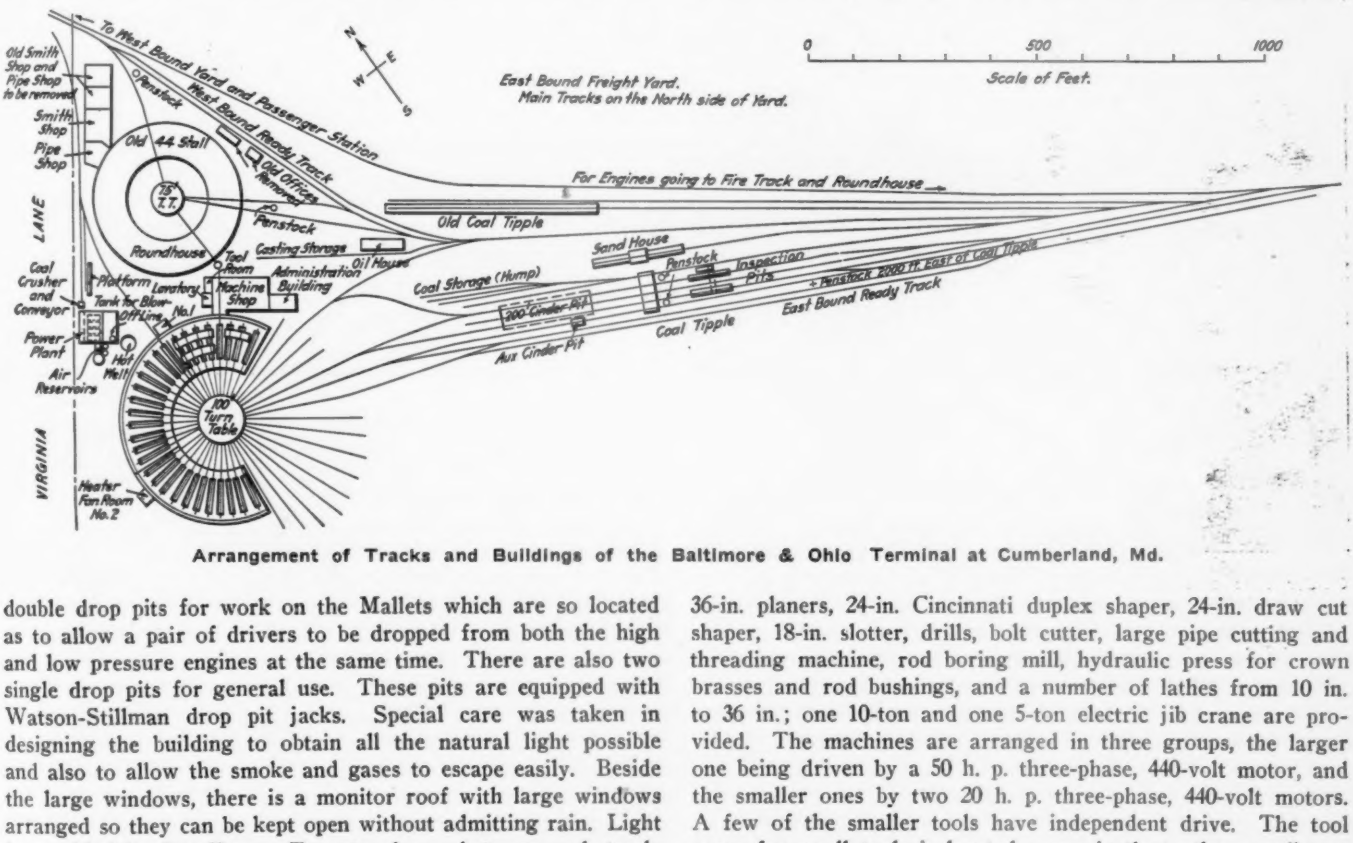
The New Roundhouse Is Designed for Mallet Locomotives; Coaling Station Serves Four Tracks.

BY R. C. POWERS

A number of important improvements have recently been made in the locomotive terminal at Cumberland, Md., by the Baltimore & Ohio. These include a new 30 stall roundhouse, machine shop, power plant, administration building, cinder pit, inspection pit, coaling station and sand house as well as changes made in the old roundhouse, smith shop and car wheel shop.

ROUNDHOUSE.

The new roundhouse has 30 stalls and there are 12 tracks outside which are available for storage and repairs; it is equipped with a turntable 100 ft. long, driven by a George P. Nichols & Bro. electric tractor. There is a concrete foundation and the walls are of brick, while wood is used for the roof trusses, columns, smoke jacks and window frames. The wood is used on account of the injurious effects of the gases on structural steel. The roundhouse is of sufficient size to care for the Mallet locomotives which are in use on this division. There are four double drop pits for work on the Mallets which are so located as to allow a pair of drivers to be dropped from both the high and low pressure engines at the same time. There are also two single drop pits for general use. These pits are equipped with Watson-Stillman drop pit jacks. Special care was taken in designing the building to obtain all the natural light possible and also to allow the smoke and gases to escape easily. Beside the large windows, there is a monitor roof with large windows arranged so they can be kept open without admitting rain. Light is provided by five 60-watt Tungsten lamps between each track, and there are also four receptacles for hand extensions. The building is heated by two B. F. Sturtevant type H. S. 2 heating units composed of a series of coils heated by low pressure steam, the air being heated as it passes these coils and then forced by a fan through ducts to points adjacent to each pit and along the inside of the outer wall; the openings are about 3 ft. above the floor and covered with a wire netting. Each track has a three-phase 440-volt receptacle to attach small motor-driven tools. There are three outlets from the roundhouse, which prevents congestion in case of accident on any of the outgoing tracks. Each pit is fitted with air, hot and cold water and blow off connections. The floor in the heavy repair or dead section is of mastic rock over a concrete base, and in the live section is of treated wood blocks placed on end over a concrete base; there are two dividing or fire walls. The roof is of ruberoid heavily covered with compound.



Arrangement of Tracks and Buildings of the Baltimore & Ohio Terminal at Cumberland, Md.

MACHINE SHOP.

The machine shop is of the same general construction as the roundhouse with the exception of steel roof trusses and doors made by the J. G. Wilson Manufacturing Company. It is 70 ft. x 140 ft. The windows are large and there is a monitor roof; the floor is of treated wood blocks over a concrete base. The shop does not form part of the roundhouse, but is adjacent to the drop pits and connected by a covered track; this was done to obtain better natural lighting. The artificial lighting is done by 28 250-watt lamps and there are also plugs for hand extensions; the same system of heating is used as in the roundhouse. The equipment of machine tools consists of a 90-in. wheel lathe, 400-ton wheel press, 42-in. boring mill, 52-in. boring mill, 24 and 36-in. planers, 24-in. Cincinnati duplex shaper, 24-in. draw cut shaper, 18-in. slotter, drills, bolt cutter, large pipe cutting and threading machine, rod boring mill, hydraulic press for crown brasses and rod bushings, and a number of lathes from 10 in. to 36 in.; one 10-ton and one 5-ton electric jib crane are provided. The machines are arranged in three groups, the larger one being driven by a 50 h. p. three-phase, 440-volt motor, and the smaller ones by two 20 h. p. three-phase, 440-volt motors. A few of the smaller tools have independent drive. The tool room for small tools is located conveniently to the roundhouse and machine shop. A large wash room is provided for the employees.

POWER PLANT.

The power plant was built near the roundhouse, from which come the greatest demands for air and steam. The construction is similar to that of the other buildings, except that the floor and roof have a concrete finish. There are four Sterling class A No. 18 boilers, two air compressors of 800 cu. ft. capacity each, one fire pump, a Fairbanks-Morse 18 in. x 10 in. x 12 in. duplex piston pump and a boiler washing system. The boilers are fed by Roney stokers through chutes from storage bunkers; the boiler feed is provided by two Worthington 10 in. x 6 in. x 10 in. duplex outside packed, plunger pumps, taking water from a

Cochrane feed water heater. Natural draft is obtained by a 200-ft. brick stack and regulated by a Richard Thompson Company damper regulator. The washout system is the Winslow and consists of a hot well outside of the power house, a circulating tank inside and two Pratt Iron Works 12 in. x 10 in. x 12 in. duplex piston pumps.

A fire protection system of 22 alarm boxes and 18 hydrants is provided, and a team of firemen is maintained and regularly trained. While there is sufficient floor space for electric generators in the plant the current is being purchased from the local company and is supplied at the switchboard at 2,300 volts, 60 cycles. There are two General Electric 50-light constant-current transformers for arc lights in the yards and terminals, one Adams-Bagnall 25-light constant-current transformer for flame arc lamps around the shops and coaling station, and three 50 k. w. 2,300-440 volt transformers for power. The 2,300-110-volt transformers for multiple lighting are located near the point of consumption, but controlled from the switchboard. All high tension circuits are controlled by oil switches with automatic release.

The coal for the boilers is dumped from cars into hoppers over a crusher and after being crushed it is taken up by means of chain buckets and dumped on a conveyor belt which conveys

Cinder Pits and Roundhouse With Machine Shop and Old Roundhouse on the Right.

it to the desired point. The crusher is run by a 20 h. p. Westinghouse electric motor, and the elevator and conveyor are driven by a 7½ h. p. motor of the same type, the arrangement being interlocked to prevent congestion at any point.

ADMINISTRATION BUILDING.

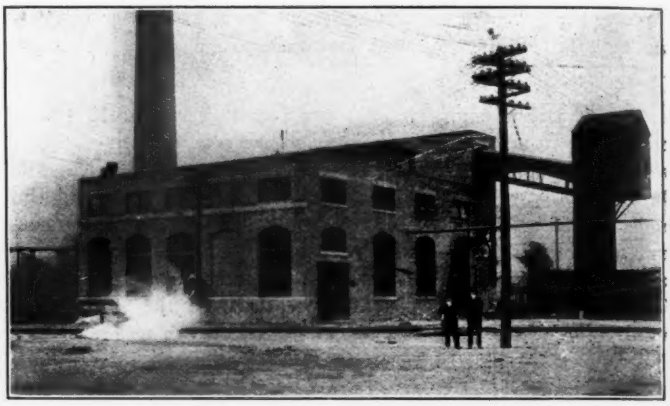
This is of the same general construction as the others and is built on the east of the machine shop. The entire basement is used for general file rooms for records; the first floor provides offices for the road foreman of engines, roundhouse foreman and general foreman, engine despatchers, callers and division storekeeper, and the second floor, for the assistant master mechanic, general car foreman, division master mechanic and the timekeeper. It is heated by low pressure steam and lighted by 60 watt electric lamps in fixtures suspended from the ceiling.

CINDER PITS.

The cinder pits are of the submerged type, constructed of reinforced concrete with a steel framing for the crane runway. There are two of them, 8 ft. deep, 20 ft. wide and 200 ft. long with one track between them for cinder cars. The cinders are allowed to fall into the pit, where they are wet and are then taken out and put in the cinder cars by means of a clam shell bucket and Whiting Foundry & Equipment Company 10-ton crane, electrically driven and travelling the full length of the pits. There is an auxiliary beside the large pits for outbound engines. This has room for five three-ton buckets which are taken out and dumped in the large pits as desired by means of a jib crane which is equipped with a five-ton Sprague electric hoist.

INSPECTION PITS.

There are two inspection pits constructed of reinforced concrete and each of sufficient size to accommodate two locomotives.



Power Plant, Showing Hot Well on the Left and Coal Conveyor on the Right.

They are connected by a self-draining tunnel, 5 ft. wide and 6 ft. deep, at one end of which there is a stair leading to the inspector's shop. There are facilities here for making light repairs, such as adjusting parts or renewing set screws and nuts without putting the locomotive in the roundhouse. The pits are equipped with electric lights and hand extensions.

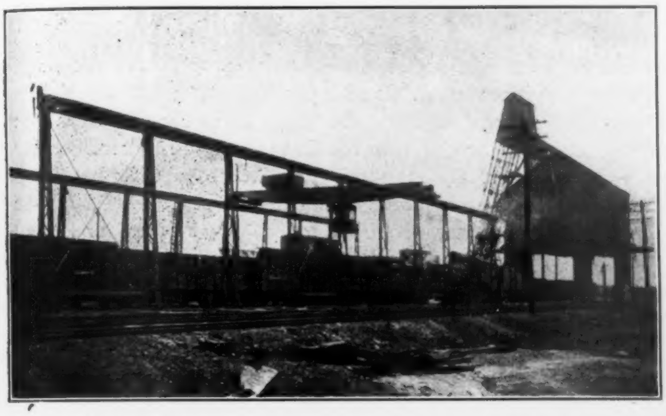
COALING STATION.

From the accompanying illustrations an idea of the construction of the coaling station may be obtained. It is of reinforced

Interior of the Machine Shop.

concrete and steel, the tower being inclosed with corrugated iron. The structural work shown open is the inclined elevator shaft for the buckets. There are four coaling tracks with two chutes for each track, and the bucket capacity is 600 tons. The coal is elevated by means of a two-bucket cable, each bucket holding about five tons. The buckets are operated by means of a drum, compound geared to a 35 h. p. electric motor, the

cables winding on and off alternately as the loaded bucket ascends and the empty one descends. The hoist is controlled by a Cutler-Hammer full reverse, skip hoist, automatic controller and is also protected by limit switches. The loaded cars, as they are received from the mines, are stored on a three-track hump, holding about 20 cars, and as desired they are allowed to roll down over the hopper. The coal passes through chutes with gates operated by the elevator buckets, allowing just enough to pass to properly fill the bucket; it is then distributed to any of the four bins as desired by means of chutes. This is necessary



Cinder Pits and Coaling Station, Looking East.

on account of using different kinds of coal for different classes of locomotives or service.

SAND HOUSE AND DRYER.

The sand buildings are constructed of wood, and are of a somewhat new type, being elevated to permit the sand to be dumped into the storage bins which are provided with covers or trap doors. A trolley is provided through the entire length, and is equipped with a ½-ton self-dumping bucket by means of which

Interior of the Engine Room Showing Fire Pump, Air Compressor and Boiler Washing Plant.

the sand is taken to the dryer. The dryer is of the steam heated gravity type, the dry sand being allowed to run into a tank equipped with a valve so that when closed the sand is forced by compressed air through pipes into bins at the top of the coaling station. This arrangement is in duplicate sets. The dry sand bins are provided with chutes so that a locomotive may obtain sand from any of the coaling tracks. There is storage provided for 1,200 cu. yds. of green sand and 20 cu. yds. of dry sand.

OLD ROUNDHOUSE.

The old roundhouse will be retained for the smaller locomotives with a part of it remodeled for a storehouse for material and supplies. The old machine shop is now being fitted up for boiler, smith and pipe shop purposes. The tools in this shop will be driven by a 30 h. p. Westinghouse electric motor and a 10 h. p. Allis-Chalmers motor. The boiler shop tools consist of punch, shears and rolls, and the pipe shop will have the usual equipment for such stations. The smith shop is fitted with one 1,800-lb. steam hammer, one cutting off machine, one upsetting machine, one scarfing machine for 2¼-in. tubes, and a duplicate set for 5-in. tubes.

CAR WHEEL SHOP.

The car wheel work which was formerly done in the machine shop has been moved to the steel car plant. This not only places this work under the general car foreman, but reduces the handling of old and new wheels, as a large part of the wheels are used in the car repair yard. The car wheel equipment consists of one Putnam double head axle lathe, one Putnam boring mill, one Niles 300-ton wheel press driven by a 30 h. p. electric motor, and one journal grinder driven by a 5 h. p. electric motor. In

Repair Shop for Steel Cars.

addition, the car plant is equipped with a 620 cu. ft. steam driven air compressor, punch, shears, drill, emery stone and bolt cutter. Great care has been taken in making these improvements to consider the comfort and safety of the employees. Guards have been installed on all gears, belts and reciprocating parts and around pits, etc., and warning signs posted.

The new terminal was designed and constructed by Westinghouse, Church, Kerr & Company, New York.

WHAT A LOCOMOTIVE BURNS.—The problem which confronts the railway officer in considering this subject is an extensive one. To obtain from the modern locomotives the average power required from them it is necessary to consume fuel at the rate of about 100 lbs. of coal per square foot of grate per hour, and to obtain the maximum power required it is necessary to consume 150 lbs., and at times in excess of this amount, per square foot of grate per hour. That is, to obtain the power necessary to perform the work demanded, a boiler which from its heating surface would be rated at about 320 horsepower is frequently forced to develop over 1,500 boiler horsepower, and our records show that another boiler, which would on the basis of heating surface be rated at about 400 horsepower, has developed as high as 1,994 boiler horsepower. The performance stated above requires coal consumption at the rate of from 6,000 to 10,000 lbs. of coal per hour, and this has been done on a grate of 55 square feet.—*D. F. Crawford before the International Society for the Prevention of Smoke.*

THE USE OF SAND ON LOCOMOTIVES

BY F. E. PATTON

Sand is regarded by some people as an item of little importance, but it plays a very important part in the performance of locomotives, both in fuel economy and in handling tonnage, if properly used in starting trains and on grades. It also prevents the wear of tires caused by unnecessary slipping. There is a certain grade of sand used on some roads that has considerable clay in it, and scarcely any glass. This is used instead of lake or river sand on account of its being available with only a short haul, and the difference in the price is very little, if any; but even if it costs a little more it is better economy to obtain good, sharp sand for locomotive use if it is available.

Sand boxes and sand pipe joints are sometimes neglected, and locomotives frequently arrive at terminals in rainy weather with wet sand in the box and the pipes clogged; very often the box is filled with dry sand before the wet sand is removed. The engineman may report the sanders as needing cleaning, and it is then necessary to empty the box to do the work right. The box and pipes should be absolutely free from moisture and the valves should have the same opening on each side. Frequently an engineman will say that he cannot get over the road with one box of sand on account of having to use the hand lever, claiming that he has too many brake pipe leaks to use the air sander, as its use would result in sticking the brakes, and one valve would be partly open before the other started to open and in order to get sand on both sides he would be using too much on one side. With sanders adjusted evenly on both sides it is not always necessary to hold either one open for any length of time after the train is started. If it is necessary to use sand to prevent slipping after the train is in motion it can be used for short distances at intervals, as there is always enough sand sticking to the tire to hold the locomotive for a few rail lengths after the sand is shut off. This results in a saving of sand and lessens wheel friction.

Enginemen on arrival at terminals should open the air sander just before stopping at the point of relief, and shut it off after stopping, moving the locomotive a few inches beyond where the first stop was made and opening and closing the sand valves. When inspecting the engine they should note the operation of both sanders and whether there is sand in the box, and should be able to report any defects. If sand is working on one side only, or is wet in the box and pipes, the hostler and roundhouse foreman should be notified not to sand the engine until the wet sand is removed and the leaks repaired. Sand should be properly screened and handled by careful men, as it is very essential that it may be depended on to respond in any emergency. Very often a piece of waste is found in the box or in one of the pipes at the top, which has been dropped by the men sanding the engines; as a rule it is found in the left pipe, which would indicate that it was placed there for the purpose of saving sand and labor, the men thinking that the engineman will not notice it as he can see the sand running on his side; enginemen should not leave a terminal without sand working on both sides.

It is very important that the sanding devices measure alike on both sides, as sand can then be used sparingly and regulated so that the tonnage can be handled successfully at all points. As a rule, when an engineman starts out with a full box of sand he is not very free in using it until he discovers that he has used the greater part of it; if, at that time, he has only covered a part of the division, it will require careful work to complete the trip successfully unless he is able to obtain sand at some intermediate point. If an engineman drops a little sand every time he starts his train he will find that the locomotive will not slip so easily after the train is started, and that he can get over the road with very little, accomplishing a saving in sand and fuel and saving wear on the tires.

Passenger locomotives are often observed to slip a few turns when starting at stations. The engineman takes a chance on the locomotive's not slipping, and if it does slip he closes the throttle and drops a little sand. If he would get the habit of dropping a little sand on every start the engine would never slip, and in making a stop where the grade is ascending it is a good policy to drop a little sand before coming to a stop. Passenger engines usually stop at about the same spot at stations, and when they try to start without sand they slip; this being done every day makes the rail very bad at that point, and if the grade is ascending the next freight train following will probably slip there if the engineman is not on the alert. This slipping of the freight engine might necessitate doubling or reducing the train. Careless slipping causes tires to be ground down and also puts a hard glazed surface on the rails, which takes time to wear off; as long as tires are in this condition it requires considerably more sand to hold the locomotive, often necessitating the dragging of a train over a heavily sanded rail, which would not be necessary if more care were taken. If sand boxes and sand pipe joints can be made water proof and a good grade of sand is used, there should be no cause for stalling on hills, if the tonnage is not excessive and no brakes are applied. There is nothing more aggravating or trying to an engineman's patience than to try to get over the road on a bad rail with a box full of wet sand or pieces of coal and waste lodging in the sand valves as fast as they are cleaned.

With everything in good working order, there is still another condition which causes trouble on long runs when the rail is wet; this is the clogging of the sand in the bottom ends of the pipes, when it becomes necessary to jar the pipes to knock it out. There should be some device used to keep the bottoms of sand pipes clean on long runs, and in freezing weather this should be watched closely, as at such times the sand is likely to freeze solid in the pipe.

The general storekeeper of a certain trunk line recently told me that there were more right-hand brake shoes used than left-hand shoes, and asked me if I could explain the cause. This condition should not exist, as the wear should be the same. I told him, however, that it might be possible that a great many locomotives were running with the left sand pipe stopped up, which would cause the right shoes to wear out faster if sand is used in making stops. If such is the case, it not only reduces the efficiency of the locomotive, but also works a hardship on the mechanical department.

Private-car Trouble in England.—After the end of this year no wagons (freight cars) will be allowed on the railways in Great Britain which are not fitted with spring buffers. This is in accordance with a notice issued by the Clearing House seven years ago; but it is said that the proprietors of coal mines have from 8,000 to 12,000 wagons still in use which have only "dead" buffers—those not fitted with springs. What can be done with these cars after December 31 is a question which now gives rise to some anxiety.

Steam and Electric Locomotives.—From the information offered by many writers on the subject, one would be led to believe that a steam locomotive is a most wasteful machine and that tremendous savings would result from abandoning their use. As a matter of fact, the performance of the locomotive boiler compares favorably with the average results obtained in stationary practice, and the performance of the complete locomotive, of modern construction, is sufficiently efficient to permit of obtaining a coal rate of 2.1 lbs. per indicator horsepower hour, or 2.5 lbs. of coal per horsepower hour delivered at the drawbar of the tender. Surely such results do not warrant the almost general belief that the locomotive is an inefficient machine for the purpose for which it is intended.—*D. F. Crawford before the International Society for the Prevention of Smoke.*

SHOP PRACTICE

MACHINE SHOP KINKS

BY H. T. NOWELL,
General Foreman, Boston & Maine, Concord, N. H.

EXPANSION ARBOR.

An inexpensive expansion arbor or mandrel that may be used to good advantage on work requiring bushings is shown in Fig. 1. This device eliminates the necessity of having numerous straight mandrels of varying diameters. It is necessary to have

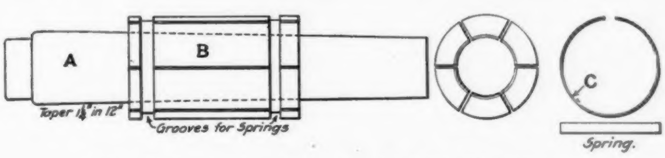


Fig. 1—Expansion Arbor for Light Lathe Work.

only two sizes of the taper pins *A* and about three sets of the split shells *B*, for any size of hole from ⅞ in. to 2 in., as one of these arbors will expand about ⅛ in. When the outside shells are made they are turned up like a bushing, then sawed into six pieces and marked in sets; when finished the sets are held together by the spring *C*. These arbors hold exceptionally well when the tool is taking the cut, and are easily driven off on account of the sharp taper of the pin.

HEAVY EXPANSION ARBOR.

A heavy expansion arbor made for turning the outside and ends of side rod bushings for locomotives, in a lathe at one setting, is shown in Fig. 2. The main feature of this arbor is that it is not necessary to remove it from the machine when a bushing has been completed or when a new bushing is put on. This saves the workman considerable trouble as well as time for both the arbor and the bushing together would be quite heavy. The arbor screws on the lathe spindle and the left hand cone is fastened to the arbor collar by a dowel pin. The right hand cone *A* is held in position against the work by the nut *B*

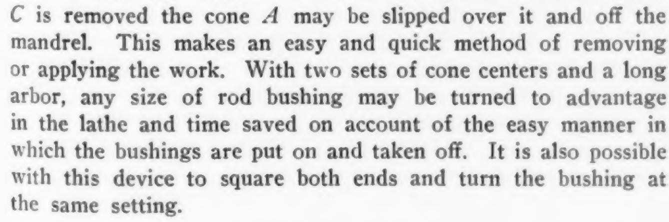


Fig. 2—Expansion Arbor for Turning Side Rod Bushings.

and the collar *C*. The nut *B* is of such size that when the collar *C* is removed the cone *A* may be slipped over it and off the mandrel. This makes an easy and quick method of removing or applying the work. With two sets of cone centers and a long arbor, any size of rod bushing may be turned to advantage in the lathe and time saved on account of the easy manner in which the bushings are put on and taken off. It is also possible with this device to square both ends and turn the bushing at the same setting.

CHUCK FOR THREADING STUDS.

Fig. 3 shows a head for holding studs while the thread is being cut on the end for the final operation. In making the studs they are turned, threaded on one end and then cut off at the correct length in a hollow spindle machine in one operation. When the required number has been made, the head shown in the illustration is placed in the machine. The jaws *A* are held open by a spring and are closed by the plunger *B*, which has a conical head and extends through the head of the machine. The jaws are removable and are made in sets to accommodate the different sizes of studs. This arrangement will save considerable time over the old method of screwing the stud into a stud set, where it has to be screwed in and out each time a new one is

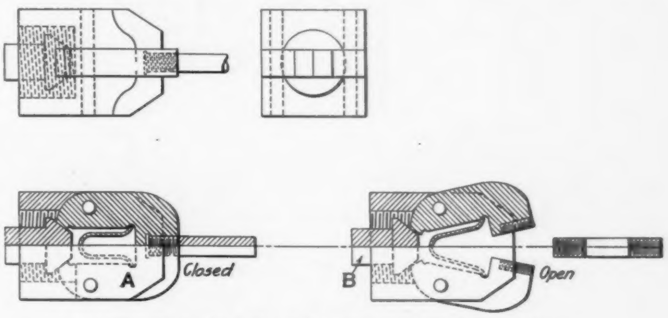


Fig. 3—Lathe Head for Threading Stay Bolts.

put in. This device can be easily made in any shop at a small cost and is applicable to nearly all hollow spindle machines.

EXPANSION REAMER.

An expansion reamer which was built in this shop to ream a hole in a certain class of crossheads that have a shoulder at the bottom of the hole, is shown in Fig. 4. A reamer of this design

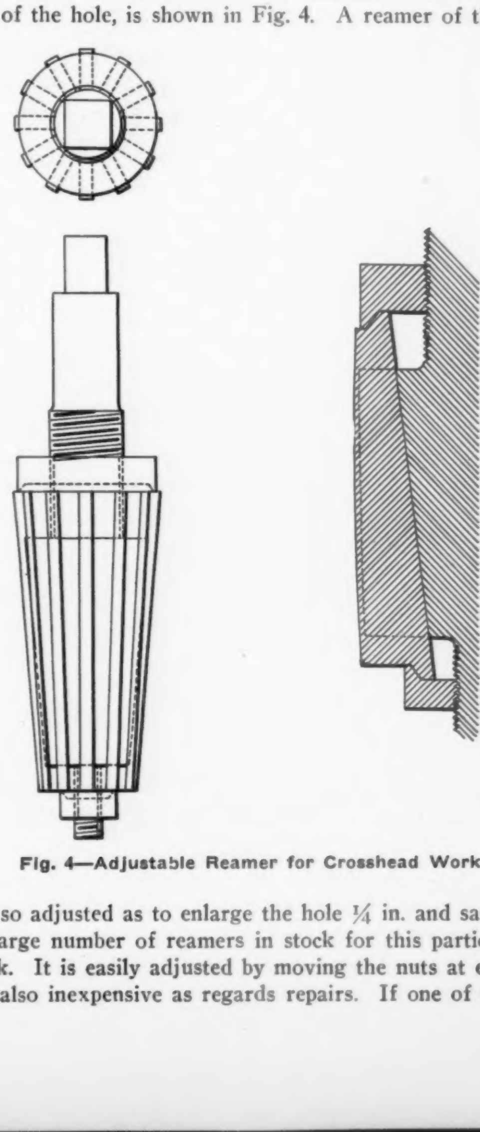


Fig. 4—Adjustable Reamer for Crosshead Work.

can be so adjusted as to enlarge the hole ¼ in. and saves carrying a large number of reamers in stock for this particular kind of work. It is easily adjusted by moving the nuts at either end, and is also inexpensive as regards repairs. If one of the blades

should break a new blade is made to pattern and inserted and the reamer is then reground on a grinding machine.

STOCK FEEDERS FOR TURRET LATHE.

A device made to pull heavy bar stock through a hollow spindle turret lathe that has no roller feed attachment is shown in Fig. 5. This can be made to take any size stock up to 6 in., the size of the machine, by the two sliding heads *B*. The shaft *D* fits in one of the holes in the turret head and is carried in the head all of the time. Where a piece of work has been cut

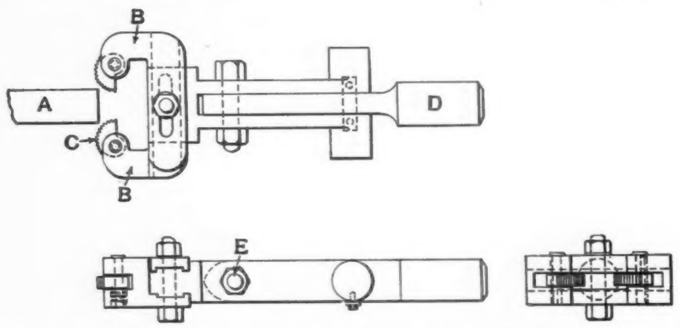


Fig. 5—Adjustable Jaws for Pulling Work Through the Head of a Turret Lathe.

off and it is desired to pull the bar through to start a new cut, the turret is brought forward so that the jaws *C* slip over the stock. When the carriage is started back the jaws grip the stock, due to their eccentric motion, and the work is drawn out the desired distance. When not in use the head of this device tips up at pin *E*, thereby giving more clearance for the turret on the carriage when turning around.

FILING VISE FOR CROSSHEADS.

A device for holding a four-bar crosshead while dressing up the wrist pin, is shown in Fig. 6. The crosshead is firmly gripped at the side by set-screws operating in the two dogs *B* as shown in the illustration. This was made from a scrap link hanger and

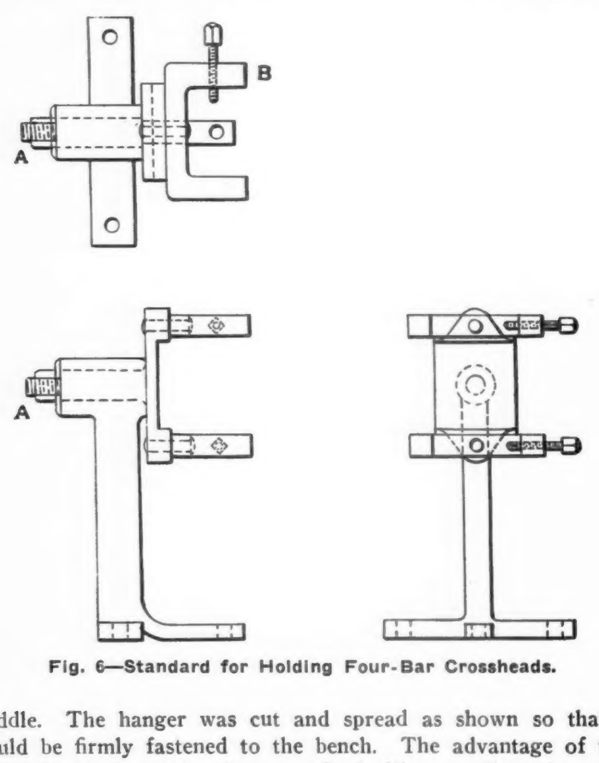


Fig. 6—Standard for Holding Four-Bar Crossheads.

saddle. The hanger was cut and spread as shown so that it could be firmly fastened to the bench. The advantage of this device is that it enables the man who is filing to adjust the crosshead to any position which he may desire by simply slacking the nut *A*.

JIG FOR DRILLING CROSSHEAD SHOES.

The Jig shown in Fig. 7 is used for drilling holes in the shoes of an alligator crosshead. The shoe is placed in the frame *B* and clamped in position by the bar *D*, extending across the top of the shoe, and the cams *E*. The jig is fastened to the angle bar

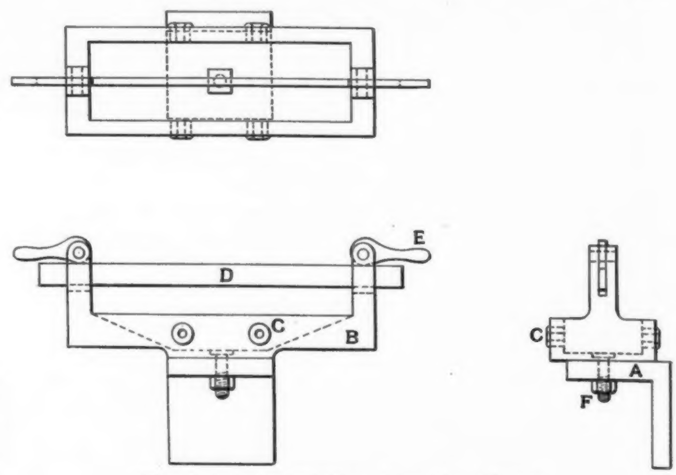


Fig. 7—Jig for Drilling Crosshead Shoes.

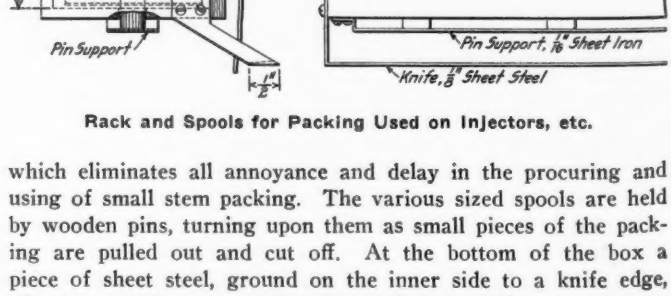
A by the bolt *F*, the angle bar being clamped to the table of the drill. The drill is guided by the bushed holes *C* and after one side has been drilled the bolt *F* is slackened, the jig turned around and the other side drilled. The arrangement is simple in design, does the work nicely and helps toward insuring accurate drilling.

PACKING SPOOL RACK FOR INJECTOR BENCHES

BY F. W. BENTLEY, JR.,
Machinist, Butler Shops, Chicago & North Western, Milwaukee, Wis.

Packing spools, in connection with work on the injector benches, are often the source of no little trouble and aggravation to the repairman. They are of such a size that comparatively few of them take up much valuable drawer room, and if they are kept in the store room repeated trips are necessary to obtain small quantities of packing, causing a waste of the workman's time.

The accompanying illustration shows a packing spool rack



Rack and Spools for Packing Used on Injectors, etc.

which eliminates all annoyance and delay in the procuring and using of small stem packing. The various sized spools are held by wooden pins, turning upon them as small pieces of the packing are pulled out and cut off. At the bottom of the box a piece of sheet steel, ground on the inner side to a knife edge, affords a ready means of cutting off the packing.

ENGINE HOUSE ORGANIZATION AND OPERATION

Individual Paper Presented at the Convention of the Railway General Formen's Association.

BY W. SMITH

The subject of engine house efficiency can only be treated in a general way due to the many and varied conditions that are met with, such as the number of locomotives to be handled, and the class of service they are engaged in; also the class of traffic on the road, and the number of grades and curves encountered. Again if engines are pooled, the tonnage ratings excessive, and bad water conditions are met with, the problem is still further complicated. In fact, there are an infinite number of conditions that have their bearing on the subject.

Locomotive Design.—The design of locomotives, as far as the engine house is concerned, is almost uncontrollable, except that recommendations can be made to re-locate inaccessible parts and to re-design parts that are unreliable. Then there are certain desirable features that can be recommended for promoting efficiency in the engine house, such as boiler checks with shut off valves attached, which make it possible to grind in the checks with the engines steamed up; also syphon cocks located on the dome for conveniently blowing off steam. Pistons with long rods that can be pushed far enough ahead to renew cylinder packing, without cutting the rod loose from the crosshead are also to be commended. As a move in the right direction, locomotives are being turned out of the locomotive works at the present time with an auxiliary dome or manhole cover, which makes interior inspection of the boiler possible without removing the throttle standpipe.

Cost of Repairs and Handling.—That local conditions largely determine the cost of repairs is shown by the fact that the cost of repairs per mile in this country varies from 4 to 16 cents. Reduction in cost per mile can be brought about, however, by making the best possible use of the men and facilities available, together with good judgment, and economy in the use of material.

The scrap value of some of the material removed from locomotives amounts to considerable. Hence workmen should be required to bring the scrap material to the storehouse in exchange for the new. What material to require an exchange on will readily suggest itself. Metallic piston rod and valve stem packing should be included, as most kinds have a scrap value of about 20 cents per pound. Parts that can be reclaimed, such as engine truck, tank, and trailer brasses should be exchanged in the same manner. This method will tend to keep the house in a tidy appearance, and less time will be consumed in sorting scrap.

Nothing about the roundhouse should be allowed to go to waste—even dirty waste can be reclaimed, and condemned air hose can be made into throttle gland packing.

The importance of a well stocked storeroom cannot be overestimated. When repair parts are not in stock, the broken parts have to be expensively patched, or new ones have to be made at great expense, or else the engine is held out of service while the repair part is sent for. The stealing of parts from one engine for another, which is a fruitful source of trouble and expense, is also an outcome of lack of material. Of course when motive power is standardized it is easier to keep the necessary material on hand, due to the fewer variations in the size and design of the parts. This in turn reduces the costs.

Enginemen should be educated to report work accurately. Shot gun reports, such as "Engine blows," run up the cost of repairs. It costs money to pull valves and take off cylinder heads.

Roundhouse kinks and handy devices when developed to meet the existing conditions of power are great time and money savers.

Labor conditions in the vicinity affect the cost of handling somewhat, but much can be done in the way of reduction by a good organization.

Causes of Failures.—Engine failures will occur as long as there are locomotives in service, and it is only by eternal vigilance, on the part of everybody concerned, that they can be held to the minimum. There are innumerable causes for engine failures, some of which are uncontrollable as far as the engine house is concerned, such as defects in material and design, and poor workmanship during locomotive construction and general repairs.

But, by far the greater number of failures are caused by the lack of skill, care, or judgment on the part of those in charge of inspection, repairs, or handling. Failures are sometimes caused by the neglect of the foreman to have the proper repairs made, either because of poor judgment in deciding that the work reported was unnecessary, or in the oversight in not having the proper repairs made.

Over anxiety to get engines back on their regular runs, after they have received heavy repairs, is a common cause of failure. Good judgment would dictate to run such engines on unimportant runs a sufficient time to develop unexpected trouble.

Prevention of Failures by Discipline.—The problem of engine failure largely concerns the human element. Hence to keep down engine failures, the human element must be controlled, and that means good discipline. Discipline when properly administered will do much to eliminate failures. In some cases, friendly censure or words of caution may have the desired effect; in other cases it may be necessary to resort to suspension.

Each failure should be promptly investigated, and, if possible, traced to the individual or individuals responsible. As aids in this direction complete reports should be required. The chief train despatcher should notify the master mechanic, by wire or telephone, immediately after the occurrence of a failure, and in addition he should send in a daily report showing all engine failures.

In every case of failure, engineers should be required to make out a complete failure report—preferably on a special form provided for that purpose. Some roads furnish a printed form, which when properly filled out by the engineer, gives all the information in detail. Of course these forms are the dread of every engineer, and they will do everything possible to prevent a failure, if it is for no other reason than to save themselves from making out one of these forms.

Another report should be made out by the roundhouse foreman, in which he should give such information as the cause of failure in his estimation, the work that was previously reported, and by whom it was done.

When enginemen, inspectors, foremen, and workmen know that each failure will be traced to the individual responsible, and the blame placed accordingly, they will take every precaution to keep the blame from their shoulders.

In order to have the desired effect on the men, a daily report of failures on the division should be posted in a place accessible to all. Most roads compile a record by divisions; it is a summary of engine failures from each cause on each division, and for the whole road. In order that comparisons may be made, the total number of failures, and miles run per engine failure is shown for the previous month, and the corresponding month of the previous year. This report should also be posted, as it has a tendency to create a feeling of rivalry between the men of the different divi-

sions, and it gives the men to understand that they are in a measure responsible for results.

The scheme of giving roundhouse men a bonus for discovering defects that would cause an engine failure has considerable merit. This bonus is given in so many hours off with pay, depending on the importance of the discovery.

Periodical Examinations and Tests.—As a means of preventing engine failures, and of improving locomotive performance generally, periodical examinations and tests have not been given the attention that they warrant. Of course the Federal boiler law defines how often boilers, staybolts, steam gages, and pops must be tested so that is not a matter of choice. Aside from these required tests, there is no general practice—in fact, only at the most efficient engine houses has the matter been taken up.

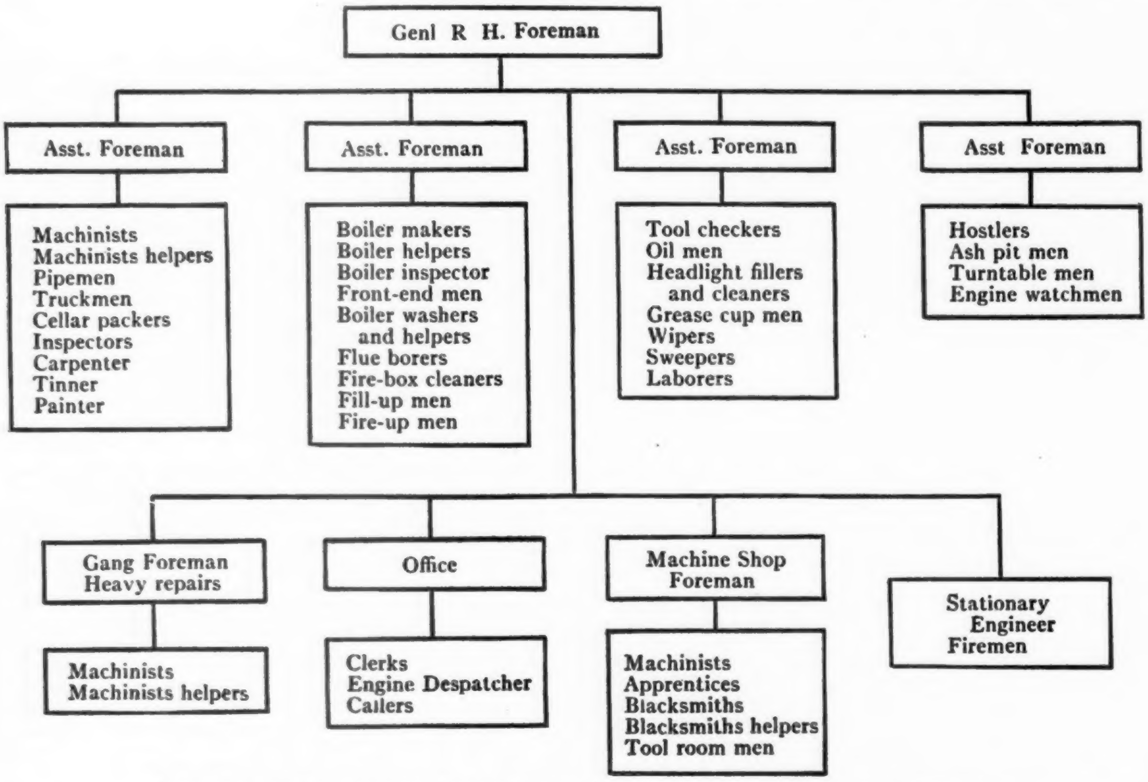
Just what work should be performed periodically, and what the intervals should be, is largely a matter of conditions and appliances used. If tank water scoops are used, they should be gaged each trip, and if compound locomotives with intercepting valves are in service, the intercepting valve should be examined at least every three months. Superheater locomotives have presented new problems of maintenance, and where the best results are obtained the superheater tubes are tested with water pressure at three months intervals, and the cylinder packing and valves are examined monthly.

To prevent trouble from hot driving boxes, the perforated plates in grease cellars should be examined monthly, and cleaned off if necessary—this to insure a good feed of grease to the journal. All hard grease should be removed from the cellar at this time, and the box re-packed.

Other work that is performed periodically at different engine houses consists of removing drawbar pins each month for inspection; cleaning out tanks each month; draining main air reservoirs each week; gaging height of drawbars and pilots each week; examining piston nuts and follower bolts of built-up pistons each month; testing air brakes each week; examining smokebox draft arrangements and ash pans each week, etc. When periodical examinations and tests are made, it is very important that a suitable record should be kept of each.

In order to prevent failures from air pumps not working, air pumps should be changed every six months.

High Mileage Between Shoppings.—In order to get maximum mileage from engines between shoppings, all inspections should be made in a thorough manner, and all adjustments and repairs should be given immediate attention. Aside from this, there are certain features with regard to locomotive maintenance, which if controlled will greatly prolong the life of an engine between shoppings. The first is unnecessary or excessive flange wear of driving tires; in some cases this may be overcome by re-spacing tires or putting engine in tram. The second is excessive lateral motion in drivers; this may be prevented to some extent by keeping lateral well taken up in engine trucks and trailers. The third is improper condition of driving boxes; this may be prevented to a large extent by maintaining shoes and wedges in good condition. The fourth is lost motion in rods and connections; this is controlled to some extent by keeping the driving boxes in proper condition. It is also necessary to renew a rod or knuckle bushing occasionally, and to keep the main rod brasses reduced.



Organization of an Average Engine House Handling Locomotives Mostly of One Class.

As an aid to making high mileage between shoppings, square valves should be mentioned. When the valves are properly adjusted the engine can be worked lighter to do the same work, thus saving wear and tear on the machinery.

An engine can be kept in service for so long a time that while the cost per mile run will be apparently low, and while getting over the road without failures, the cost per ton mile may be very high. This should not be mistaken for efficiency.

ORGANIZATION.

The importance of a good organization in the engine house cannot be overestimated. In fact, it is the keynote of the whole situation. Even when the conditions are favorable, and modern facilities are provided, if the organization is not on a sound basis, the results obtained will be inefficient.

By organization is meant, "the selection and assignment of men, and the distribution of responsibility for results." Hence, in an efficient roundhouse organization, each foreman and each

workman should have his duties clearly defined, and should be given to understand that he is responsible for the work he performs.

An organization to be effective must also provide for the loss or transfer of workmen or foremen—that is, there must be men trained for every job so that when absences or vacancies occur, the operation of the engine house will not be affected in the least.

Then the selection of men should be given some attention, and not by the common method of "hiring and firing."

An organization to be effective must have enough supervision to relieve the foreman of too much detail work. There is no question but that the inefficiency of many engine houses is due to lack of supervision.

The engine house foreman should be directly responsible to the master mechanic for results, but the latter should not interfere with the actual supervision of the engine house, as such a practice is sure to spoil the authority of the foreman with his men, and consequently the organization as a whole is weakened. The master mechanic should communicate all instructions, suggestions, and criticisms directly to the foreman, and not to individual workmen or assistant foremen.

After an efficient organization has been perfected, the problem that confronts the foreman is to maintain it. This is a question which largely concerns his personality. He should be a firm disciplinarian, and at the same time should have the good will of the men. He should be quick to think and act, and above all should be a keen observer. It is important also that he should be able to key up the organization when the power is badly needed. A spirit of loyalty among the men is one of the greatest aids to efficiency in the engine house, and that can sometimes be brought about by an occasional word of encouragement.

Two methods of organization, which are shown in the accompanying charts, are intended to meet average conditions. The first is for the average engine house which handles engines mostly of one class, either freight or passenger. The second shows an organization especially adapted for large main line engine houses, handling both freight and passenger power. The second differs from the first in that separate foremen are provided for freight and passenger repairs. There is much to commend in this plan, but it has the disadvantage of bringing some of the workmen under the supervision of two foremen at the same time.

These organizations are intended for engine houses segregated from the back shop. In this case moderately heavy repairs are usually made, and hence, a heavy repair gang is provided. A heavy repair gang aids to the efficiency of an engine house, because it offers a means of getting immediate action on a rush job, and it is valuable to the organization because it gives a place to draw men from, when there is a shortage in other gangs.

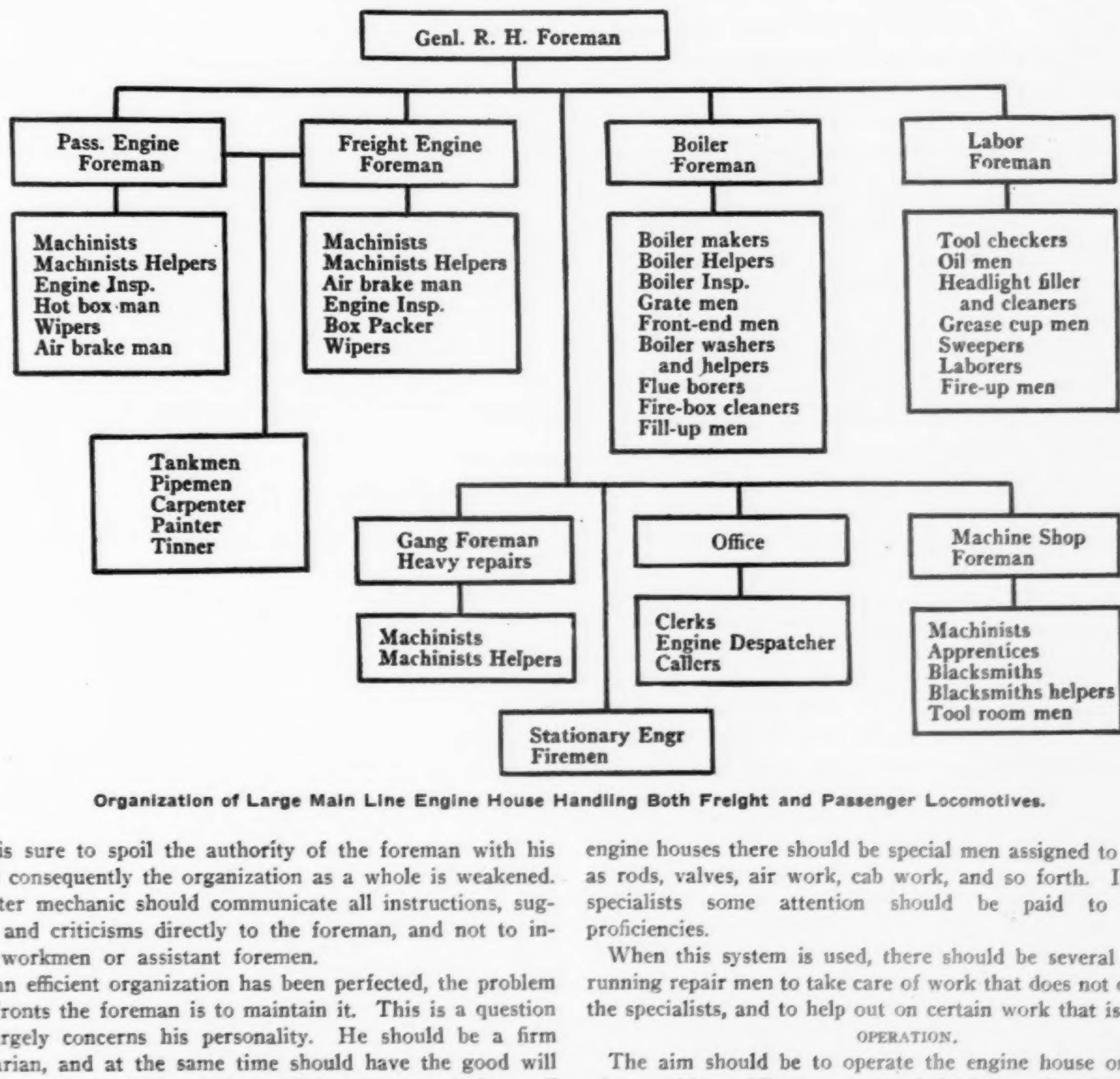
In order to get highest efficiency, work should be specialized as far as consistent. Of course the size of the engine house will determine how far this system can be carried. When work is specialized, the special men generally have the special tools required, and are thoroughly familiar with the work. In large engine houses there should be special men assigned to such work as rods, valves, air work, cab work, and so forth. In choosing specialists some attention should be paid to individual proficiencies.

When this system is used, there should be several all around running repair men to take care of work that does not come under the specialists, and to help out on certain work that is behind.

OPERATION.

The aim should be to operate the engine house on the basis of a machine. All movements of the locomotive, from the time of its arrival on the engine house tracks until its departure, should be given the closest attention. The longest delay before an engine is run in the house ordinarily occurs at the clinker pit. Hence the need of especially close supervision at that point. If enginemen are educated to bring in engines, with plenty of steam, full of water, and not excessively heavy fires, an efficient gang of fire knockers can cut the delay down to a surprisingly low figure.

Ordinarily, washing out is the longest operation performed in the house. By all means, there should be a hot washing and



Organization of Large Main Line Engine House Handling Both Freight and Passenger Locomotives.

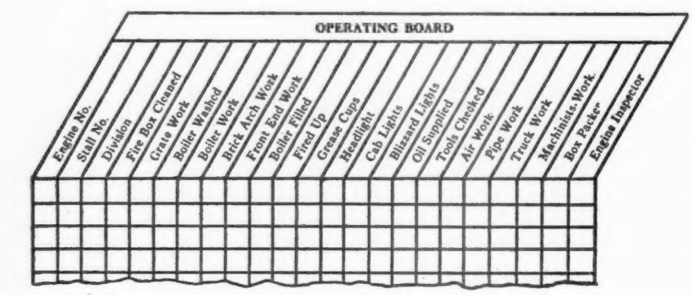
filling system, together with a blowing down line, so that this work will be facilitated as much as possible. Then if every minute is taken advantage of, after the engine stops in the house, the delay from this source need not be more than two hours. In this connection, it should be mentioned that the time to bore out flues is when boilers are washed, and it should be the practice to bore out flues thoroughly every time a boiler is washed.

After boilers are washed more or less time is consumed getting steam on the engines. Of course the skill of the fire-up man counts for something, but the method of firing up and the intensity of the house blower are equally as important. There are three methods commonly used for firing up, and each method has its advocates. The first makes use of the crude oil firing up machine, the second uses shavings and oil, and the third uses wood and oil.

Work such as the filling of grease cups, cleaning and filling of headlight, etc., should be performed as the engines come in the house, and not after they are ordered as is sometimes the custom.

In large and busy engine houses mechanics should work on eight-hour shifts. Thus the twenty-four hours in the night and day can be divided into three shifts and there will be men working at all times. In this way running repairs can be taken care of promptly, and without the necessity for overtime.

As a means of keeping tab on all engines in the house, as to how near they are ready, etc., the engine house should be provided with an operating board. On this board all operations that



Operating Board for Engine House.

may be performed are listed, and it is the duty of the workman who performs the operation to check or O. K. the board when the work is completed. A board intended to suit average conditions is here shown. As soon as an engine arrives in the house, the hostler helper who came in with it, should mark down the engine number, together with the stall number. One of the foremen should afterwards insert the division name. If an engine is for the back shop, or it is to be held 24 hours or more for repairs, he should also insert:—"Held for Repairs," or "Held for Work," so that workmen can give other engines the preference.

There should also be a washout board to show when engines were last washed out. For the sake of convenience, there should be a space on the board, to give numbers of engines due for washout.

As a convenient means of communicating certain information to hostlers and others, there should be a suitable blackboard located in the hostlers' quarters. This board should give such information as engines due for washouts, engines that are not to be coaled on arrival, etc.

The turntable house should also be provided with the same sort of a board, to inform turntable men what engines are due for washout, or to call their attention to certain engines that are to be spotted on the drop pit to have wheels changed, or anything of that sort. Even if there are no especial stalls set aside for boiler washing, it should be the aim of turntable men to put engines in stalls that are not next to fire walls. If anything turns up after an engine is in the house, that makes it necessary to move the engine to the drop pit or to another stall, if an engine is dead, the boiler should be filled with air from the house line, and moved by that means. This is a much quicker and cheaper method than firing up the engine.

For a matter of record it is necessary to know the time of each engine in and out of the house. Turntable men should be provided with a suitable book, or form, in which to keep this record.

In order that the day and night foremen may inform each other of any unusual occurrences, and that they may give each other the necessary information concerning the condition and disposition of power, a running log should be maintained. The method of keeping this log is shown below. It represents the turn over from the day foreman to the night foreman.

Thursday, April 15, 1913.

3009—This engine held to have superheater pipes ground in.
3015—Extra engine to be used in place of the 3009.
3828—Hold this engine and crew for a special that will be ordered around midnight.
3888—Extra passenger engine. Fired to protect night trains.
3810—Hold for the back shop on arrival. See that the tank is not coaled up.
3660—Just in. Spotted on the drop pit to have No. 2 tank wheels changed, on account of cut journal.

The day and night engine despatchers should maintain a separate book, giving the engine crew situation. A third book should be kept by the boiler maker foreman to give a line-up of the boiler work. These information books, while not strictly official, should be filed for reference.

It is very essential that some good method be employed to keep track of engine crews. In this case, the time-honored blackboard should be replaced by a system of tags or blocks worked out to meet the special requirements.

LOCOMOTIVE MAINTENANCE.

In order that arrangements can be quickly made for doing some heavy work, or that an engine may be immediately ordered out again, locomotives should be inspected at the earliest possible moment after they arrive. The question of a detailed inspection is a very essential one, and to get the best results the work should be specialized as much as possible. In the ordinary engine house, handling both freight and passenger power, there should be an engine inspector for passenger engines, another for freight engines, a boiler appliance inspector, an air brake inspector, a front end and ash pan inspector, and a boiler inspector. The duties of each inspector should be clearly defined, either by sheets of instructions or otherwise, and they should not be called upon to help out on work outside of their regular duties. One road has gone so far as to furnish inspectors with printed instructions.

Whether inspectors should be required to do any of the actual work of making minor repairs or adjustments, found necessary, depends on conditions. Ordinarily, engine inspectors can replace missing cotter keys in the time it would take them to make out a written report of it. Hence in most cases it is advisable to require them to put in cotter keys. Some roundhouses provide the engine inspector with a helper whose duty is to follow along and tighten loose nuts, put in cotter keys, etc.

In order to prevent engineers from becoming lax in their inspections, it is the custom in some places to send them a mimeographed form stating that they overlooked important defects that the engine house inspector had found. In each case a copy is sent to the master mechanic.

Two methods of reporting work are in general use; the first makes use of a special form, and the second a work report book. Probably the most satisfactory method is to have a work report clerk to whom the engineer dictates a memorandum of any repairs or adjustments that he considers necessary. Each separate subject is given a special space. After the report is entered the engineer reads it, and if satisfactory to him he personally signs it. This method has the advantage of keeping the reports clean and legible, and of giving the foremen a better idea of what is required.

Work slips should be made out from the work report book or

form with a special slip for each job. Preferably the slip should be a special form about 3 in. x 5 in., with blank spaces for the job to be done, the engine number, date, and signature of the workman. When blank paper has to be used it should be in the pad form and about 5 in. wide. Each job should be listed separately on the sheet, and then torn off with a paper cutter. A work report, slipped out in this way, is shown below.

3967—Left main driving box runs hot.
3967—Examine right valve for blow.
3967—Adjust bell ringer.
3967—Open sanders.

Each slip when torn from the sheet should be at least an inch and a half wide. The back of the slip should be left blank for the signature of the workman. Work reports should be marked with a check, when they have been slipped by the clerk—this is to indicate that items have been made out on slips.

When a special form or card is provided for work slips they should be filed away for reference when the work is completed, and they have been properly signed and dated. If the work is designated on ordinary pad paper, it is necessary to have a special reference book with the work reported on the left-hand side of the page, and the workman's name opposite the job on the right-hand side. Of course in this case the clerk will have to check over all work slips turned in and sign the workman's name in the book opposite the job he performed. When this is done the work slip is of no further use and can be destroyed.

It is essential that some system be employed to take care of incomplete work reports—that is, work reported but not done when engine was last in the house. It often happens that it is impossible to do all work reported before the engine leaves the house, but if the incomplete work slips are properly filed away the work can be attended to on the return of the engine, provided it has not been done at the other end of the road. Such slips should be signed and dated on the back by the foreman, together with a brief explanation why the work could not be done, such as "Too short time," "No material in the store room."

In all cases the work report books should be at the disposal of the enginemen, so that they may know what work has been reported by the inspectors, and by the man who came in on the engine; also that he may know what work has been done and by whom it was done. With this information at hand the engineer can inspect the work that has been done, and can make sure that the mechanic has not left any nuts loose or cotter keys out. It also gives him a chance to look after any brasses that have been reduced, or anything of that sort.

In order that the engine house foremen may have an exact knowledge of all work that has been reported, and that they may pass judgment as to how thoroughly the work is to be done, and also that the engines may be promptly reported for service when the work is completed, the work foreman should distribute the work slips personally. As far as possible, he should examine the work reported before the slips are distributed, so that mechanics will not waste time doing unnecessary work. He should also make sure that engines are blown off before he gives out such work as to grind in gage cocks.

In this connection it should be said that the work foreman can do much to promote efficiency by properly analyzing the work slips. If the same work is reported on the same engine a number of times, it is evident that there is some disturbing influence; it should be his duty to find out just where the trouble lies. It may be that a rod pin runs hot; instead of doctoring the pin each time it is reported, the engine should be trammed up, or otherwise examined to determine the source of trouble.

Work slips can be very efficiently distributed and collected by means of the work distribution board. This board consists of a number of tin boxes, which are each divided into two parts—one for slips of work to be done and the other for finished work slips. Each workman is assigned to a box and his name is stenciled below it. The boxes are each about 3 in. x 4½ in., and each compartment 1½ in., which is the usual width of a work slip. When a workman finishes the slips he has, he goes to the board, deposits the finished slips, and then takes the new consignment.

The system of standard practices, that has been introduced on some roads, is without doubt a great aid in the maintenance of locomotives. There is no question but that considerable waste and inefficiency result when work is done according to varying individual judgment and opinion. When standard practices are used, the allowable limits of wear, the conditions under which to renew worn parts, the lateral to be allowed truck boxes, etc., are definitely determined.

In some cases where standard practices are not used on the entire system, individual master mechanics have framed up a number of rules, with regard to the allowable limits of wear, the application of piston valve rings, etc. These are for the guidance of foremen and mechanics, and when closely followed out are an aid to efficiency.

ENGINE HOUSE EQUIPMENT AND FACILITIES.

There is no question but that modern equipment and facilities will do much to increase the efficiency of an engine house, but it is usually conceded that they are of secondary importance to methods and organization. Unless very heavy repairs are to be made, expensive equipment such as traveling cranes will not, as a rule, give a fair return on the money invested.

The value of a good turntable and tractor cannot be overestimated. The cost of delays that result from a poorly operating table would sometimes pay for a new installation. The turntable should be power driven by sufficient power so that unnecessary time is not spent spotting engines, and that there may be some margin of power for very bad weather. There should also be a positive lock to prevent derailments due to improperly lined tracks. The tracks should line up with the table at both ends, or the turntable motor should be provided with a drum and clutch attachment, so that dead engines may be easily pulled in or out of the house.

Drop pits are a very essential part of the roundhouse equipment, even when heavy repairs are not the rule. The rapid wear of truck wheels under large capacity tanks, and the frequent mishaps to trailer wheels makes it necessary to drop wheels at frequent intervals.

The tool room should be run on the check system, and not only should the man in charge see that tools are returned and kept in order, but he should make necessary repairs as well, and otherwise see that tools are ready for immediate use. The room should be large enough so that the entire tool equipment can be kept there, including jacks, pinch bars, etc.

There should be combined with the tool room a sub-store room, which should carry a certain stock of bolts, nuts, washers, cotter keys, small pipe fittings, etc. This will avoid unnecessary trips to the store room.

Ordinarily, a considerable part of the time of mechanics is consumed getting together necessary tools for the work. In order to facilitate matters, some of the mechanics should be provided with portable tool boxes, which should contain all the tools for the special work they are assigned to. This tool box can easily be wheeled to the place where the work is to be done, and obviates the need of workmen running back and forth to their tool drawers or to the tool room for necessary tools. These boxes are also convenient to stand on for some kinds of overhead work. A portable tool box and work bench combined is still more valuable for certain special workers. Of course a good vise must be attached to the bench.

To facilitate moving from one engine to another, all special tools such as boring bars, valve setting rollers, tire setting outfits, etc., should be mounted on suitable wagons. When not in use these should be wheeled to a special place provided for them.

A portable floor crane for handling cylinder heads, pistons,

main rod ends, and other heavy parts below the running board is a very valuable addition to the tool equipment of any roundhouse.

Some means should be provided for moving heavy parts such as pistons and side rods to and from the machine shop. A special two-wheeled wagon, with a long tongue will answer the purpose very well. Some engine houses are provided with a narrow gage industrial track, which extends around the outer wall of the inside of roundhouse, and to the machine shop, store house, etc. Small push cars are operated on this track for transporting heavy parts and material.

To prevent boiler washers from dragging the washout hose from one engine to another, they should be provided with a cart on which is a reel for rolling the hose. A place should be provided in the body of the cart for carrying wrenches, nozzles, etc. This scheme also has the advantage of keeping the hose off the floor when it is not in use.

MACHINE SHOP AND AIR BRAKE ROOM.

When the engine house is segregated from the back shop, and fairly heavy repairs are to be made, a complete machine shop should be provided. The following machine tools are recommended to meet average conditions:

1 16 in. Bolt lathe.	1 Bolt cutter to take up to 2 in.
1 18 in. Lathe.	1 Turret head bolt cutter ½ in. — 1½ in.
1 24 in. Lathe.	1 Pipe threading machine.
1 20 in. Drill press.	1 Cut-off saw.
1 40 in. Heavy drill press.	1 Emery wheel.
1 22 in. Shaper.	1 Hydraulic or screw press for driving box brasses, rod bushings, etc.
1 48 in. x 48 in. x 8 ft. Planer.	
1 36 in. Boring mill.	

A boring mill is a rather expensive machine, and if conditions do not warrant the added expense, an attachment for holding rocker boxes, driving boxes, etc., to the carriage of a lathe can be obtained. This can be adjusted to any height. The boring bar is carried on the centers of the lathe, and as heavy a bar as is possible on a horizontal mill, can be used.

The air brake room should be located in the machine shop and it should contain all the special tools for maintaining air brake apparatus. Suitable testing racks should be provided, so that feed valves, etc., can be tested before they are applied. Here, also, repairs should be made to special appliances such as superheater dampers, lubricators, injectors, etc.

A blacksmith shop equipped with at least one power hammer, and one or two open forges should be operated in connection with the machine shop.

In order that the engine house foreman may get in rapid communication with various under-foremen and others, at large terminals, there should be a telephone system between master mechanic's office, roundhouse office, clinker pit, coal chute, and other points that local conditions will determine.

In every large engine house more or less time is spent by the different foremen looking for each other when something important turns up. As an aid in this direction, an air whistle can be located in some convenient place in the roundhouse, and a suitable code of signals can be arranged. This system of signaling has been installed in Los Angeles engine house of the Southern Pacific, and with splendid results.

Safety First.—Everything possible should be done by an establishment to hold its supervisors alive to the importance of preventing chances for accident, to adopt accident prevention and safety devices wherever possible, but not to depend upon these devices to the exclusion of the eternal vigilance required from every individual connected with the place to consider safety first. It is admitted that all this makes an extra load to carry, but humanity alone would require it, if indeed the selfish side of it did not make it obligatory at the present time.—*Thomas D. West before the American Foundrymen's Association.*

SCRAPPING LOCOMOTIVE BOILERS WITH THE OXY-ACETYLENE TORCH

BY PAUL PLEISS

While the oxy-acetylene welding torch has come into prominence in connection with the repairing of locomotive fireboxes, in general railroads have been backward in adopting it as part of their shop equipment, the reason given being that the cost of operation of the cutting torch renders its general use prohibitive. Lack of knowledge on the part of the operator may be blamed for this mistaken idea in the majority of cases. The work of cutting steel with the torch is cheaper by far than the cutting by any other method. This is particularly the case when the material to be cut is of such shape that its transportation to the shears is a difficult matter.

In order to effect the cut as quickly as possible, with a proportionate saving in the oxygen consumed, it is necessary that the metal present as clean a surface as possible, and it is recommended that the parts to be cut be cleaned with a stiff wire brush. This will remove the major portion of the rust and scale which accumulates on boilers.

On account of the varying conditions of steel it is almost impossible to give one figure for the cutting, as conditions play such an important part, but the figures following will give an idea of the saving which may be made with the oxy-acetylene

Boiler Being Cut with the Oxy-Acetylene Torch for Scrapping.

cutting torch. The figures are actual, having been compiled by the owner of the equipment who was anxious to learn its actual costs for cutting. The material in all cases consisted of locomotive boilers, to be scrapped in such a size as to allow them to be taken to the shears and cut. The sizes averaged 3 ft. wide and 6 or 7 ft. long.

Boiler No. 1.—Weight, 21 tons, 6 tons of which were cut; ⅝ in. metal; 115 lineal ft. of cutting.

Cost: 350 cu. ft. of oxygen at 2c	$7.90
45 cu. ft. of acetylene at 2c	.90
4 hours labor at 42½c	1.70
Total cost for 115 lineal ft.	$9.60
Cost per lineal ft.	.083
Cost per ton (6 tons cut)	1.60

Boiler No. 2.—Weight of boiler, 2 tons; ⅝ in. metal; 95 lineal ft. of cutting.

Cost: 250 cu. ft. of oxygen at 2c	$5.00
30 cu. ft. of acetylene at 2c	.60
4 hours labor at 42½c	1.70
Total cost for 95 lineal ft.	$7.30
Cost per lineal ft.	.0769
Cost per ton	3.65

Boiler No. 3.—Weight of boiler, 4 tons; 7/16 in. metal; 87 lineal ft. of cutting.

Cost: 150 cu. ft. of oxygen at 2c	$3.00
20 cu. ft. of acetylene at 2c	.40
2½ hours labor at 42½c	1.07
Total cost for 87 lineal ft.	$4.47
Cost per ft.	.051
Cost per ton	1.12

Boiler No. 4.—Weight of boiler, 8 tons; 9/16 in. metal; 19.5 ft. of cutting.

Cost: 50 cu. ft. of oxygen at 2c	$1.00
6 cu. ft. of acetylene at 2c	.12
1 hour labor at 42½c	.425
Total cost for 19.5 lineal ft	$1.545
Cost per ft	.079

Boilers Nos. 5, 6 *and* 7.—Weight of boilers, 15 tons; 7/16 in. metal; 675 lineal ft. of cutting; cuts 20 in. x 6 ft.

Cost: 1,350 cu. ft. of oxygen at 2c	$27.00
450 cu. ft. of acetylene at 2c	9.00
24 hours labor at 42½c	10.20
Total cost for 675 lineal ft	$46.20
Cost per ft	.068
Cost per ton	3.08

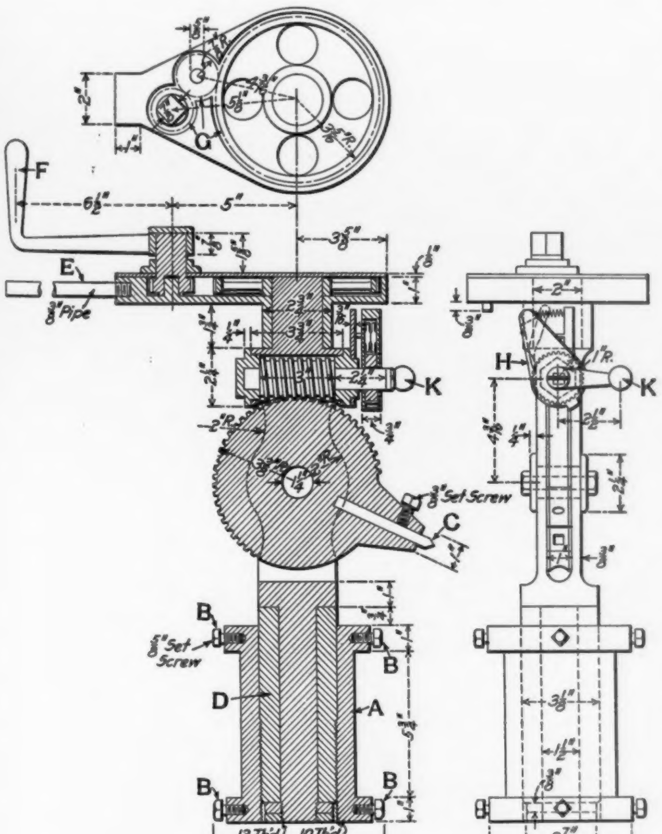
Boiler in Place on a Locomotive.—This included the cutting of the frames, smokestack, guide yokes, connecting rods, guides and other parts. The cutting was done in such a way as to allow the operator access to the boiler in order to cut it in position. The total length of the cut was not taken nor was the thickness of the material taken into consideration.

Cost: 350 cu. ft. of oxygen at 2c	$7.00
50 cu. ft. of acetylene at 2c	1.00
4½ hours labor at 42½c	1.92
	$9.92

MACHINE FOR TURNING BALL JOINTS

This machine, which was designed for turning the ball joints of steam pipes, is secured to the work by means of a chuck *A*, and is centered by the set screw *B*. The correct radius of the joint is obtained by adjusting the tool *C*, while the depth of the cut is regulated by screwing the bushing *D* in or out. This bushing is held in place by a set screw which is not shown in the illustration.

In operating the machine, the transmission housing is held stationary by the operator grasping the pipe *E* with one hand, while



Machine for Turning Ball Joints of Any Radius.

with the other he turns the crank *F*. As the machine can feed but one way, a ratchet is provided on this crank to prevent its turning the gears backward. The entire body of the machine, including the tool *C*, is turned by the crank through the gears *G*, while the ratchet *H* feeds the tool one notch each revolution through the worm. A crank *K* is provided to move the feed mechanism independently when necessary. The device is the invention of W. C. Deibert, tool foreman of the Chesapeake & Ohio at Clifton Forge, Va., and is in successful use at that point.

INSTALLATION AND MAINTENANCE OF ELECTRIC HEADLIGHT EQUIPMENT

BY V. T. KROPIDLOWSKI

IV

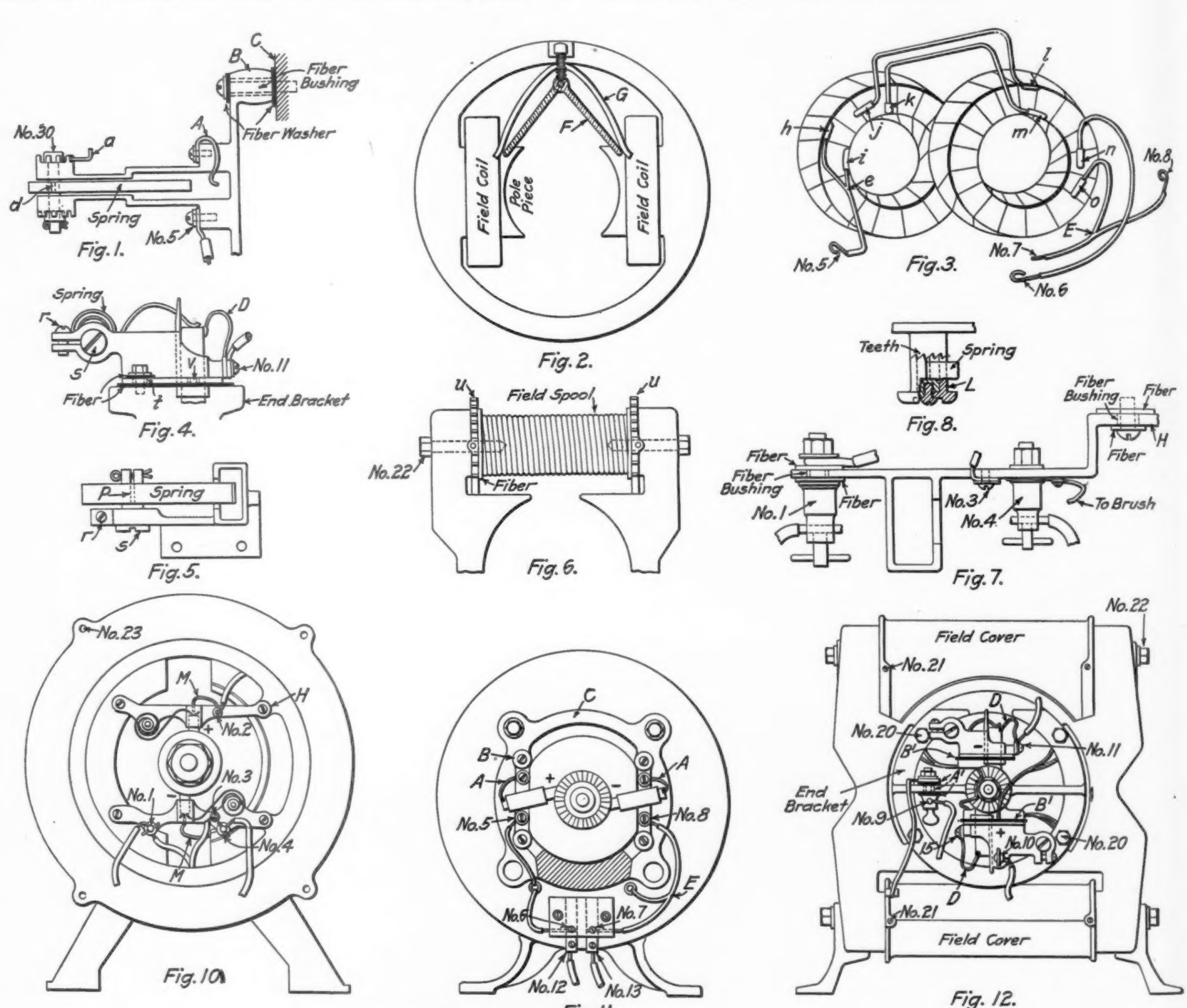
This article is intended to help the reader in familiarizing himself with the various parts of the dynamo for electric headlights. It will not be necessary to go over the last article (*Railway Age Gazette, Mechanical Edition,* October, 1913, page 546), but the reader should keep it before him. The figures used in the last article are made use of here to represent the same details. For example, Fig. 11 represents the Schroeder generator as in the preceding article, but here it is shown more nearly as it actually appears. It will therefore be necessary to explain the newly introduced details relating to the construction, which are considered most important, and it will be necessary for the reader to trace out the other numbered details in the article in the October number.

It is most important to keep in mind the insulation of the different parts, as upon this the successful operation of any electric apparatus depends and it is where most of the trouble arises, due largely to negligence and ignorance. It will be found, therefore, in the drawings that the insulation washers, bushings, etc., are conspicuously shown.

Fig. 11, as previously mentioned, is a front view of the Schroeder generator, with a section taken through the extension of the bearing housing to show the brush holders clearly. The bearing housing *C* is fastened to the field frame by tap bolts. The brush holders are secured to the bearing housing *C* with machine screws and carefully insulated from it as shown at *B* (this is shown plainer in Fig. 1) with fiber washers and a fiber bushing. The pressure with which the carbon brush should bear on the commutator is regulated by a coil spring, of which a top view is given in Fig. 1, and the tension of the spring is adjusted by the small lever *a*. The bolt *No. 30* is passed through the base of the brush holder, which has a slot *d* in it, in which the inner end of the coil spring is securely fastened, the adjusting being done by lifting the lever *a* out of the notch it happens to be in and turning it to the right or left (depending on whether the tension should be increased or decreased) and again allowing the lever to snap into one of the notches.

Fig. 2 shows how the field coils of the Schroeder machine are held in place. In order to remove the fields, take out the brushes before taking off the housing *C*, and also disconnect all the wiring; then loosen the set screw which is under the name plate on top of the field frame. This will loosen the hinge *F*, Fig. 2, when it and the fiber protector *G* can be taken out; do the same with the lower hinge by unscrewing the set screw under the field frame (this is not shown in the drawing) and the coils can then be slipped off the pole pieces. Fig. 3 shows the field coils removed. The machine is compound wound and therefore each of the two completed coils consists of two windings. The compound winding is in the inner circle of the coil and the shunt winding, of which there is much more and the wire of much smaller diameter, composes the outside circumference of the coil. The shunt winding commences at *h* and the compound coil at *i;* a lead wire is soldered to each of the ends, the two ends soldered together at *e* and a common lead brought out to connection *No. 5* of the brush, shown in Figs. 1 and 11. To the end of the shunt and series windings of this first coil are again

soldered two leads at *j* and *k*, these being carried over to the next coil and again soldered to the starting ends of the shunt and compound windings respectively at *l* and *m*. To the ends of the windings of this second coil are again connected lead wires at *n* and *o*, *n* being the shunt, and *o* the compound ends. The this having two connections, *No. 7* and *No. 8*, which are connected respectively to *No. 7* and *No. 8* in Fig. 11. The shunt and compound windings are wound separately and taped, then the compound coil is inserted in the inner circle of the shunt coil and both are again taped to form a unit.



Arrangement of Parts and Connections on Electric Headlight Dynamos.

lead of the compound winding is brought out separately and connected to the brass tube in the fiber block which is fastened to the face of the field frame, as shown at *No. 6*, Fig. 11. The lead of the shunt winding is soldered to a heavier lead at *E*, Fig. 12 shows the front view of the American generator with part of the end bracket broken off to show a portion of the commutator; this gives a plainer view of the brushes and brush holders. The construction of the brush holders and their man-

ner of application to the end bracket is shown more clearly in Figs. 4 and 5, which show respectively side and top views of the upper brush holder. The brush holders are insulated from the end bracket by fiber washers under the head of the cap bolt and under the entire brush holder, and the cap bolt is prevented from connecting the holder and the end bracket metallically by the fiber bushing *t;* the other cap bolt which belongs at *v* is not shown. The pressure of the brushes on the commutator is caused by the tension of a coil spring similar to that of the Schroeder machine, but the arrangement for regulating the tension is somewhat different. The pin *s* is split for receiving the inner end of the coil spring, and by loosening the machine screw *r* the pin *s* may be turned with a screw driver to adjust the tension. The letters A^1 and B', Fig. 12, represent respectively the insulators of the binding post *No. 9* and the brush holders. The flexible leads, *D,* connect the carbon brushes to the binding screws of the brush holders. The current from the positive brush goes through *D,* Fig. 12, to the screw *No. 15,* through the brush holder to binding post *No. 10,* to the outside circuit through the wire connected to *No. 10,* from the outside circuit to binding post *No. 9,* from there to the field winding by way of the wire connected to *No. 9,* out from the field to *No. 11,* and through *D* to the negative brush. In case the field spools of this machine need to be removed, the end bracket is first removed by unscrewing the tap bolts *No. 20,* which secure it to the pole pieces, the field covers are then removed by unscrewing the small screws *No. 21;* the tap bolts *No. 22* are unscrewed, when the field spool can be removed. Fig. 6 shows one of the field spools when the cover is removed, *u* being the bracket to which the field cover is screwed.

In Fig. 10 is shown a front view of the Pyle generator. The construction of the brush holders, as well as the way they are applied to the front half of the field frame, is shown in Figs. 7 and 8. The brush holders are insulated from the field frame at *H,* Figs. 7 and 10, by fiber washers and a bushing in the foot of the holder to prevent the screw from touching it; this is done at the foot of both holders, where they are secured to the frame. Binding post *No. 4* is not insulated from the brush holder, as the negative side of the outside circuit is connected there, making direct contact with the negative brush. The binding post *No. 1* is insulated from the holder, as shown in Fig. 7, as that is where the current from the compound field, which comes from the positive brush and enters the field at *No. 2,* Fig. 10, enters the outside circuit; one of these parts must be insulated, as otherwise the minus and plus sides of the machine would be brought together and a short circuit would result.

The method of adjusting the brush tension spring on this machine is shown in Fig. 8. The boss of the holder has notches, or teeth, and a stem projects from the boss, which is turned to a smaller diameter; a sleeve, also having teeth, is made to slip over the stem. This sleeve *L,* is drilled through its head to allow a small machine screw to pass, and the stem is threaded for this screw. A coil spring is used, the inner end engaging in a recess in the sleeve; to adjust the tension the small screw is loosened enough to disengage the teeth of the sleeve and boss, when the sleeve can be turned either way.

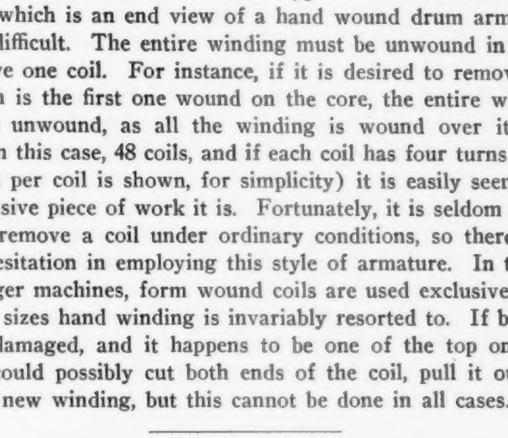
The manner of winding and the construction of a ring wound armature are shown in Fig. 13. There are many other ways of constructing this style of armature, but the principle is the same in all, only the disposition of the wires being different. A brass sleeve *No. 24* and ribs *No. 25* constitute what is called a spider; this should be of brass so as to be non-magnetic. The armature core is built up on the ribs of the spider and consists of round slotted discs of very thin sheet steel, varnished on both sides so as to reduce what are termed eddy currents, which heat the core and cause waste of energy. In the construction of this armature the thin sheets are assembled, forced together under high pressure and held with clamps until the ribs *No. 25,* are slipped on from inside the laminated core and properly spaced; the clamps are then removed and the core is held together by these ribs, which have lips projecting about half the thickness of the core. Fiber discs *No. 26* prevent the wiring from coming in contact with the iron core in case any of the insulation should become damaged. In case any of the wires of the winding became damaged so as to short circuit part of the armature, the damaged coil must be removed and replaced by a good coil. If, for example, coil *W* needs to be removed, the two soldered ends should be removed from the commutator segments at *Y* and *Z* and the ends pulled out until the turns of the coil are unwound. For simplicity, only one wire per coil is shown, but actually there are about six wires or turns to a coil. A new coil can be similarly wound in the empty space. In this type of armature it is a simple matter to replace a coil, but it is still easier to remove one from an armature having form wound coils; this type is extensively used, but not in any of the machines shown in this article.

The removal of a coil from the type of armature shown in Fig. 14, which is an end view of a hand wound drum armature, is very difficult. The entire winding must be unwound in order to remove one coil. For instance, if it is desired to remove coil *X,* which is the first one wound on the core, the entire winding must be unwound, as all the winding is wound over it; this means, in this case, 48 coils, and if each coil has four turns (only one turn per coil is shown, for simplicity) it is easily seen what an extensive piece of work it is. Fortunately, it is seldom necessary to remove a coil under ordinary conditions, so there need be no hesitation in employing this style of armature. In the recent larger machines, form wound coils are used exclusively, but in these sizes hand winding is invariably resorted to. If but one coil is damaged, and it happens to be one of the top ones, an expert could possibly cut both ends of the coil, pull it out and insert a new winding, but this cannot be done in all cases.

AIR PUMP STEAM HEAD REPAIRS

BY J. A. JESSON,
Air Brake Foreman, Louisville & Nashville, Corbin, Ky.

The accompanying illustrations show successful methods used in repairing the steam head of a Westinghouse air pump. Fig. 1 shows the method of reboring the large main valve cylinder. An adjustable blade shell reamer *A* operating on the arbor *B* is placed in the cylinder with the blades loose, the reamer being



Reamers for Repairing the Main Valve Cylinder of Air Pumps.

attached to the arbor by a pin at the top. The arbor has a close fit in the guide *C,* and when it is drawn downward by the nut *D* the reamer blades are forced out. They are then locked by the nut *E* and the reamer is revolved, making the first cut. The nut *E* is then slackened, the blades are distended still further, and a second cut is taken, the nut *E* locking the blades in their

new position as before. This process is repeated until the cylinder has been made true, and it is found that it will stand considerable enlargement before it is necessary to change from the standard size piston. Fig. 2 shows a handle that may be easily attached to the nut *D* to turn it. The blades of the reamer should be ground parallel for their full length and with about the same clearance as an end mill.

The method of truing the small main valve cylinder is indicated in Fig. 3. A solid adjustable blade reamer is used in this case, the blades being distended by tapping the reamer body instead of pulling it down as in Fig. 1. This cylinder can usually be trued up once and still use the standard piston; after that it should be scrapped or used with a piston larger than the standard. The piston rings should be ground to fit the cylinder and should have a true face on the side toward the exhaust. The reamer blades should be ground the same as those in Fig. 1.

The method of reboring the reversing valve bushing of a 9½ in. pump is shown in Fig. 4. A shell reamer with a straight hole is used on a ¾ in. arbor, which is held in the bushing as shown. With a suitable hollow wrench to fit over the pilot and in the

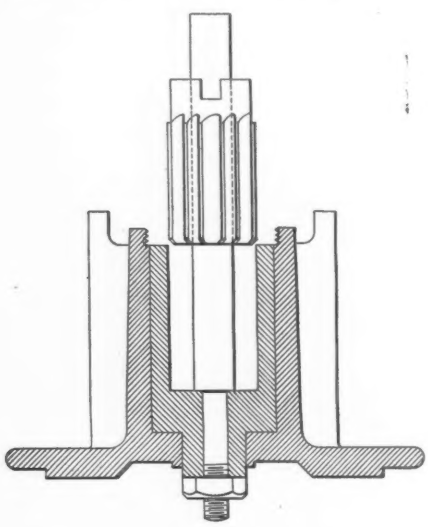


Fig. 4.

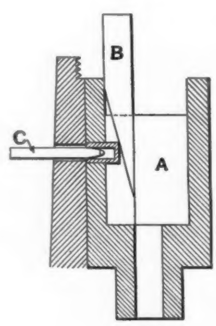


Fig. 5.

Repairing Reversing Valve Bushings of Air Pump Steam Head.

keyways of the reamer the bushing can easily be reamed by hand.

An easy method of placing a dowel in the reversing valve bushing is shown in Fig. 5. A 3/16 in. hole is drilled in the dowel pin to about two-thirds its length and the end is tapered a little so that it may be easily started. A steel block *A*, 1⅜ in. in diameter and having a slot deep enough to clear the dowel and the point of the wedged driver *B*, is placed in the bushing. By driving the wedge *B* down, the dowel is forced. The taper pin *C* is then used to spread the hollow end of the dowel, making a tight fit in the bushing.

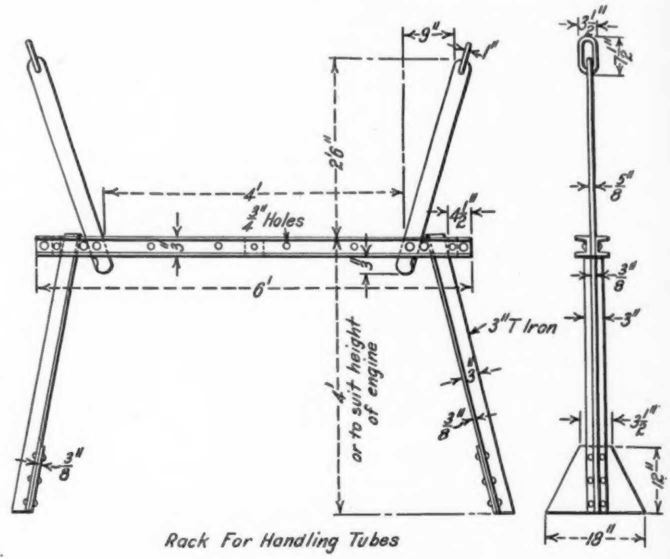
The Mechanical Stoker.—For the past nine years the Pennsylvania Lines West of Pittsburgh have been working to develop a mechanical stoker for locomotive use, and the results so far have been sufficiently satisfactory to warrant its application to a total of 300 locomotives, of which 215 are at work—66 in passenger, 130 in freight, and 19 in switching service.

Smoke and Mechanical Stokers.—Repeated comparisons of the smoke produced by locomotives with and without the stoker show that those equipped with the stoker may be operated with from one-tenth to one-third of the smoke made by similar locomotives in the same service without the stoker, the amount of the reduction depending on the class of service and continuity of the run.—*D. F. Crawford before the International Society for the Prevention of Smoke.*

BOILER TUBE RACK

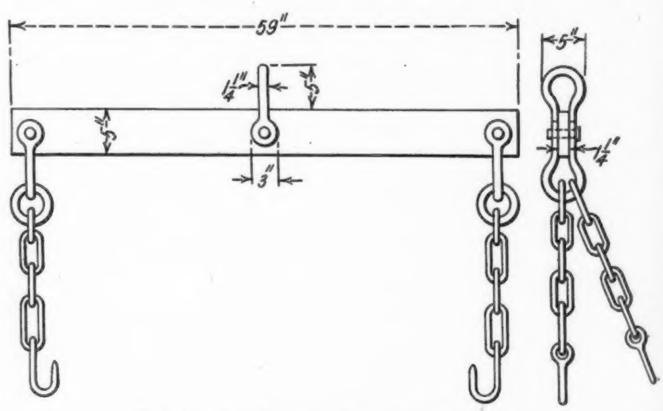
BY C. M. NEWMAN,
General Foreman, Atlantic Coast Line, South Rocky Mount, N. C.

There are in use in the boiler shop of the Atlantic Coast Line at South Rocky Mount, N. C., several very convenient racks for handling tubes. These are so constructed that they may be placed in front of a locomotive at a convenient height to receive the tubes as they are being passed out of the boiler. The legs are not attached to the rack, and it may be lifted entirely clear from them and placed on an ordinary push car



Rack Used for Boiler Tubes.

and a load of tubes delivered at any point desired. Only half of the rack is shown in the illustration and a carrier or sling is also shown for handling the rack. The ¾ in. holes between the uprights are for temporary uprights to separate the flues when they are cut to different lengths to suit the variations in the sheets. For these temporary uprights, pieces of scrap tube or pipe, flattened at one end, are used; the flattened end is punched with a ¾ in. hole and the upright is held in place by a bolt. This type of rack is used at the Rocky Mount shops to



Device for Lifting Boiler Tube Rack.

handle as many as 336 2-in. tubes, 14 ft. 6 in. long. When the racks are not in use they can be knocked down and occupy but very little space when piled in the shop.

Stopping Trains by Wireless.—A system of stopping moving trains by wireless has been invented by Professor C. Wirth, of Nuremberg, who was also the inventor of the wireless distance boat.—*The Engineer.*

CAR DEPARTMENT

TESTS OF PASSENGER CAR LIGHTING

Tests covering an investigation of the relative engineering merits of center deck and half deck system of location of lighting units in passenger coaches, the proper spacing, efficiency, illumination intensity, and uniformity of all distinctive types of lighting units of both the gas and electric systems, were recently made by the committee on illumination of the Association of Railway Electrical Engineers. The results of the tests are given in the report of this committee presented at the convention held in Chicago, October 20 to 24.

The coach employed in the test was a standard Lake Shore & Michigan Southern, 70 ft. steel underframe car, finished in light mahogany with medium olive color head lining and a dark olive green seat covering. The upper deck construction is the Empire or standard New York Central design. The tests were made at the Collinwood shops of this road and lasted about eight weeks.

It has been the generally accepted practice in comparing different systems of lighting to measure the illumination on a horizontal plane at a height above the floor corresponding to that of a typical desk or table. In these tests, however, the committee felt that the investigation of the illumination produced at the point where it would be used most frequently by the passengers was of greater importance than a comparison of the different lighting units as determined by measurement on a more or less arbitrary plane. The illumination was therefore, measured on a 45 deg. plane, 33 in. above the floor and directly above the front edge of the seat cushion, as representing more closely the average position in which reading matter is held by the passengers. Readings, however, were also taken in the usual horizontal reference plane, 33 in. above the floor to provide data for those who wish to compare the results of this investigation with other coach lighting tests, as well as to establish the ratio of illumination produced on the two separate planes with different types of units. The test stations in the latter case were 2¼ in. back from the front edge of the seat.

In the report of these tests the words "candle power" are the term used to express the intensity, or pressure, of light emanating in any given direction from a light source. It corresponds, for instance, to steam pressure in steam engineering and voltage in electrical engineering.

The word "lumen" is the term used to express the quantity of light emanated from a light source. It is analogous to the term horse power and watt as used in steam and electrical engineering. It is also defined as a quantity of light which is emitted in a unit solid angle per unit of time. The unit solid angle is that which intercepts a unit area on the surface of the sphere of unit radius. A uniform source of one candle unit emanates 4π lumens. Therefore the total lumens emitted by any lamp source can be obtained by multiplying its mean spherical candle power by 12.57. The rated lumens as given by the lamp manufacturers of the 15 watt G-18½ train lighting bulb is 119 and of the 50 watt G-30 bulb 397 lumens. To express the values in round numbers, 120 lumens for the 15 watt lamp and 400 lumens for the 50 watt lamp has been used in the test data, and all results are reduced to this basis, being expressed usually as so many lumens per running foot of car. To ascertain the illumination obtained using other sizes of lamps with any given type and arrangement of units it is necessary only to obtain the generated lumens per foot of car under the new conditions by dividing the total lumens in the passenger compartment of the car by the length of that compartment.

Three different features were investigated by these tests. First, to determine the best location and spacing of light units in the car. Second, to determine illumination efficiency and uniformity of various types of lighting units. And third, tests to determine the effect of changing the color of the head lining.

In regard to the first feature, the test showed that as far as efficiency and uniformity of distribution of the illumination produced was concerned, there was practically no difference between the center deck and the half deck systems of locating the light units. The half deck system, however, involves the installation of at least twice as many units as the center deck system, thus materially increasing cleaning cost, reflector and lamp maintenance. In connection with the proper spacing of the lamps the conclusions of the committee are that the most satisfactory illumination results are obtained with a spacing of lighting units, for the direct system of lighting in coaches, of not more than two seats (6 ft.). With indirect lighting, however, the ceiling may be considered the light source as far as its effect on the illumination produced is concerned and on account of its greater height above the seat level, as well as the large area of illuminating surface compared with direct lighting, entirely satisfactory results can be obtained with the three seat (approximately 9 ft.) spacing with this type of light.

The tests to determine the value of the various types of lighting units from the point of view of illuminating efficiency show a wide range in the various units. The more efficient ones produced over twice the units of illumination compared on an equal wattage basis. Tests were made with both open mouth reflectors of various types, bare lamps, and enclosed units, with different types of globes and reflectors. In comparing the electric lighting fixtures, all results were reduced to the same total wattage, representing 66⅔ generated lumens per running foot of car and, on the basis of illuminating efficiency or the percentage effective lumens on 45 deg. angle plane, the bare lamp gives a result of 16.3, and an enclosed unit with a light density opal globe gives 14.6, which is the lowest value recorded. Totally indirect units give a value of 17.4 and semi-indirect of 19.8. The highest efficiency, however, was given with open mouth mirrored glass reflectors which gave 39.5. On account, however, of this type of reflector being opaque and throwing heavy shadows on the deck its use can hardly be considered for direct lighting units for coach service. The next best record was given by an open mouth prismatic clear reflector which gave 34.2, and the next highest efficiency was given by an open mouth heavy density opal reflector which gave an average of 30.3. The latter, however, gave a value much lower on the window side of the seat, but in spite of this, the committee stated that its efficiency is so high that it should possess considerable attraction for those who object to the appearance and the cleaning question involved in the clear prismatic type but who do not wish to sacrifice lighting efficiency. Except in a few forms of passenger car construction, the efficiency of the indirect lighting system is rather low, and it cannot be recommended for general use until a decided advancement has been made in improving the efficiency of the tungsten lamp.

The committee reports that the need of a train lighting lamp of higher lumens capacity is indicated by the tests, but that, at the present time, none is available except at an increase in wattage which, from an operating point of view, is highly undesirable. With the present standard train lighting lamps, therefore, the use of only the most efficient types of lighting units is recommended for electric lighting where the best illumination results are to be obtained.

As might be expected the result of the test on the color of head lining showed that it had no appreciable effect on the useful illumination produced except where the lighting unit used gave a considerable portion of light by transmitting it to the ceiling. The use of a light colored head lining, however, is recommended by the committee as it produces a more cheerful effect in the car.

REPAIRING BALLAST CARS

BY KEYSER

The conditions under which the ballasting of railways is done vary to a considerable extent, depending on whether the line is under construction or is being rebuilt or repaired, the density of traffic, etc., but in too many cases little or no serious attention is given to the matter of repairing the cars used for such work. Ballast cars are very commonly treated as of small importance, and repairs which are really necessary are often allowed to pass with little or no attention, the fact that a broken or burned off journal or a trailing brake beam on such cars can cause just as much delay to traffic as a similar condition on any other class of car seeming to be overlooked.

When ballasting has to be done there seems to be, on the part of some railway officers, objection to putting on more than one or two extra car repairers to take care of the work of ballast car repairs. When a ballast pit is so located in relation to an established terminal that the repair work can be handled by the regular car repair staff, this policy, while it is to be deplored, is not so serious as in an isolated district, as the work can generally be done by overtime if necessary. But when the point of ballast supply is on an isolated branch or so located on a division as to necessitate the repair work being handled at or near the pit, it often becomes very serious. It is impossible for one or two car repairers to properly look after repairs to any great number of cars and the policy of letting bad order cars accumulate until there are enough to require a special train to move them to a terminal is a poor one, as is that of allowing the repairs to be entirely neglected.

In a case which came under the writer's notice, the work was handled with much satisfaction to all the departments concerned, and as there was not a single case of ballast car failure causing a delay to traffic during the three months the work was in progress, it was considered that the method followed was justified. The ballast pit was located a short distance off the main line and the track between the pit and the main line was little used and in poor condition so that the heavier classes of locomotives could not be used and it was necessary to either double head on 28 car trains or haul only 14 cars in a train. There were two shovels in use and the haul varied in length from about 10 to 70 miles, there being no other pit available within that distance. The repair gang consisted of a foreman who also acted as inspector, a man who looked after air brake repairs and the keeping of the journal boxes well packed, two repair men and two helpers. All classes of repairs were handled except such work as repairing broken sills, and as there was only one case of this kind, the car was removed from service and left idle.

In work of this nature there is often too little attention given to the matter of quarters for the men. In this instance there was of course, the regular assignment of boarding cars for the track men, etc., and a special car was carefully fitted up with bunks, mattresses, etc., for the exclusive use of the car and locomotive repair men, as much as possible of the locomotive repairs also being made at the pit. The meals were served with those of all the other men in the car provided for the purpose.

As soon as a train returned from a trip it was inspected and any bad order cars thrown out and placed on a track provided for repair work. This track was located out of the way of the shovels on ground over which they had previously passed and the gravel made a good dry surface for the work. Adjacent to this track was a shorter one on which cars requiring wheels changed were placed. When inspecting a train, the foreman made a note of any cars which required only trivial repairs, such as brake wheels, renewal of nuts, etc., and later assigned a man to do this work in the train, thus avoiding much of the switching which would have been necessary had the cars been moved to the repair track. The man in charge of the ballast trains was notified twice a day as to what cars were again ready for service, and these were generally switched out and replaced in the trains at noon and in the evening. The man in charge of the oiling made it a point to examine the journals of each car once a day and hot boxes, one of the greatest bugbears of ballast train work, were almost unknown.

One of the most important considerations in work of this kind is that of supplies. The writer has seen ballast pits at which a material car was furnished containing a mass of bolts, brasses, wedges, etc., thrown in indiscriminately and causing no end of trouble and much wasted time in finding material when wanted. In this case two box cars were provided, one for general stores and one for oil. One side of each was boarded up and a good lock was applied to the door on the other side, with keys for the mechanical men only. The store car was arranged inside with boxes and pigeon holes and a good supply of each necessary size of bolt, etc., furnished. It is a mistake, in fitting up store cars, to provide material that is not likely to be used; it is in the way and takes up space which may be needed for such important material as draft timber bolts, brasses, etc. The oil car had racks for barrels and bins for waste and each man was held personally responsible for the neat and cleanly appearance of both cars. A daily inspection of the material on hand was made and the nearest terminal telegraphed for additions a sufficient time in advance to prevent the supply becoming entirely exhausted. Draft timber bolts, journal bearings, and oil and waste for dope are among the most important items, and a good supply should always be kept on hand. Wheels were furnished a carload at a time, and were unloaded next to the wheel changing track, while three complete couplers were kept available at all times.

The man in charge of the car repair work at this ballast pit had had experience in a number of other pits and knew the conditions which generally obtain. In consequence he saw to it that his supply cars were furnished in an efficient manner and organized his staff along lines which he had worked out from his experience. The locomotive work was handled separately from the car repairs. The results proved most satisfactory, there being no failures of ballast cars on the road during the entire time that the work was in progress and a minimum of hot boxes. Enginemen knew, in starting out with a train, that the slack in the brakes was properly adjusted and that they did not need to take chances in making stops. The conditions were particularly appreciated by the trainmaster and other operating officers and the trainmen, when they learned that real efforts were being made to keep the car equipment in good shape, went out of their way to help in the work instead of using it as roughly as possible, as is more often the case. Considered from any viewpoint, the results obtained fully justified the efforts which were made.

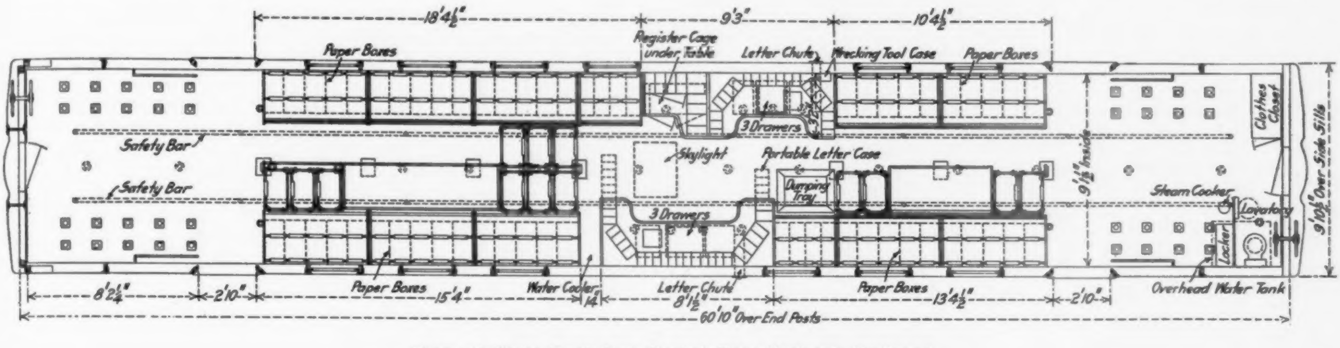
TRAFFIC ON THE NEW YORK SUBWAY.—The total number of passengers carried last year by the Interborough Rapid Transit Company on the subway and elevated lines in New York City was 634,316,516, an increase of more than 27,000,000 over the previous year. The greater part of this increase was on the subway division, and was due principally to the ten-car express service.

Wabash 60-Foot Steel Postal Car

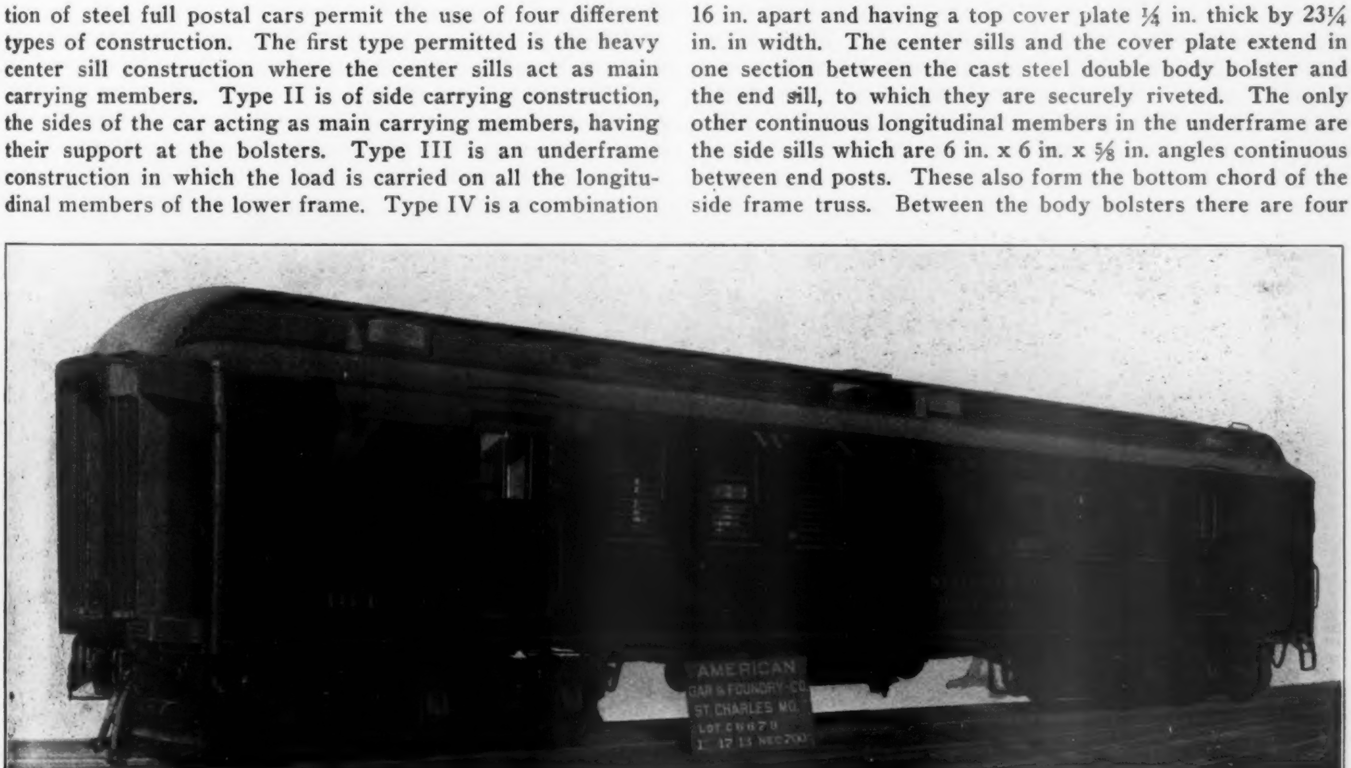
Built in Conformity With the Latest Post Office Department Specifications and Drawings.

The Wabash Railroad has had in service for several months five all-steel, 60 ft., full postal cars which conform in every way to the railway mail service specifications as revised to December 28, 1912. These cars were the first full 60 ft. steel cars to be built to these specifications. They were designed by the American Car & Foundry Company and, together with a number of other all-steel passenger cars for this road, were built at the St. Charles plant.

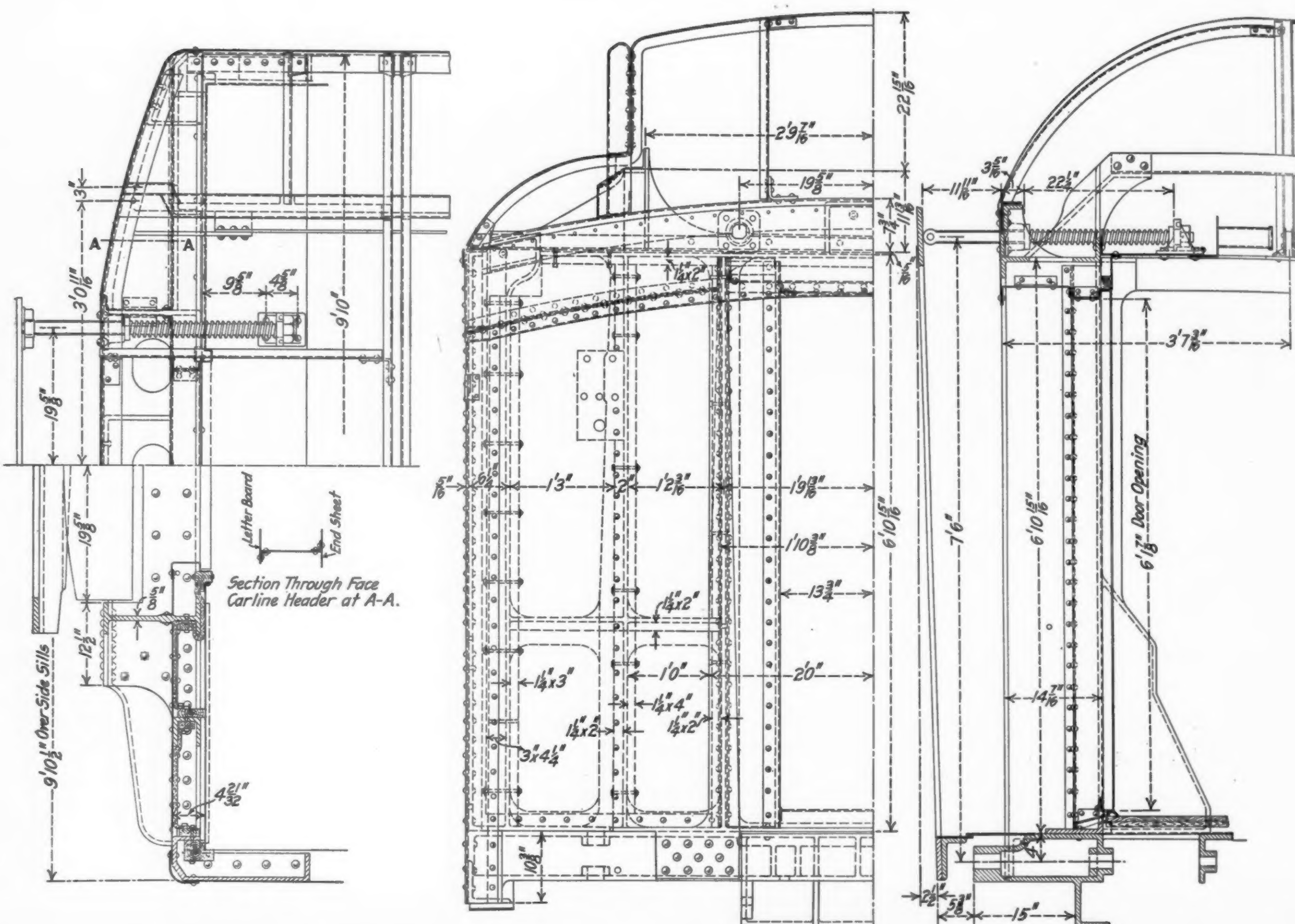
The post office department specifications for the construction of steel full postal cars permit the use of four different types of construction. The first type permitted is the heavy center sill construction where the center sills act as main carrying members. Type II is of side carrying construction, the sides of the car acting as main carrying members, having their support at the bolsters. Type III is an underframe construction in which the load is carried on all the longitudinal members of the lower frame. Type IV is a combination construction in which the side frames carry a part of the load transferring it to the center sills at points remote from the center plate for the purpose of utilizing a uniform center sill area. The Wabash cars are of type II where the side frame is used for the carrying members and transfers the load to the bolsters. This, of course, implies a light center sill of only sufficient area to take care of the buffing and pulling stresses. The specifications state that the maximum end shock due to buffing shall be assumed as a static load of 400,000 lbs., applied horizontally at the resultant line of the forces acting at the center line of the buffing mechanism and at the center line of the draft gear, respectively. Assumption can be made that this force shall be resisted by all continuous longitudinal members below the floor level, providing such members are sufficiently tied together to act in unison. For fulfilling these conditions in the Wabash car the center sills are composed of two 10 in., 35 lb. I-beams, set 16 in. apart and having a top cover plate ¼ in. thick by 23¼ in. in width. The center sills and the cover plate extend in one section between the cast steel double body bolster and the end sill, to which they are securely riveted. The only other continuous longitudinal members in the underframe are the side sills which are 6 in. x 6 in. x ⅝ in. angles continuous between end posts. These also form the bottom chord of the side frame truss. Between the body bolsters there are four cross bearers of built-up pressed steel shapes and plates, and in addition the underframe is stiffened and the side and center sills are further tied by floor beams of pressed channel section. These are of No. 10 steel and, in connection with the cross bearers, carry the floor supports of No. 10 steel pressed in Z bar section arranged longitudinally as is shown in the illustration. These in turn support the lower floor of No. 16 steel plate. The upper floor, in two courses, is of



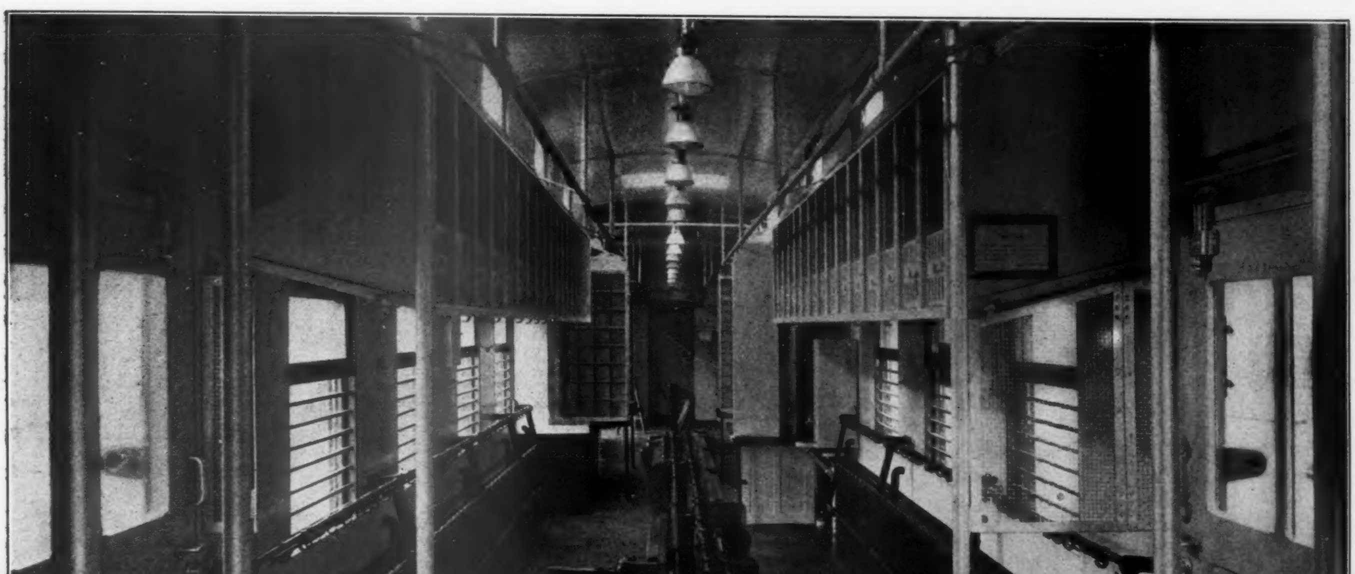
Plan of Sixty-Foot Full Postal Car; Wabash Railroad.



Exterior of Wabash Sixty-Foot Full Postal Car.



Hood and Cast Steel End Frame of Wabash Steel Postal Car.

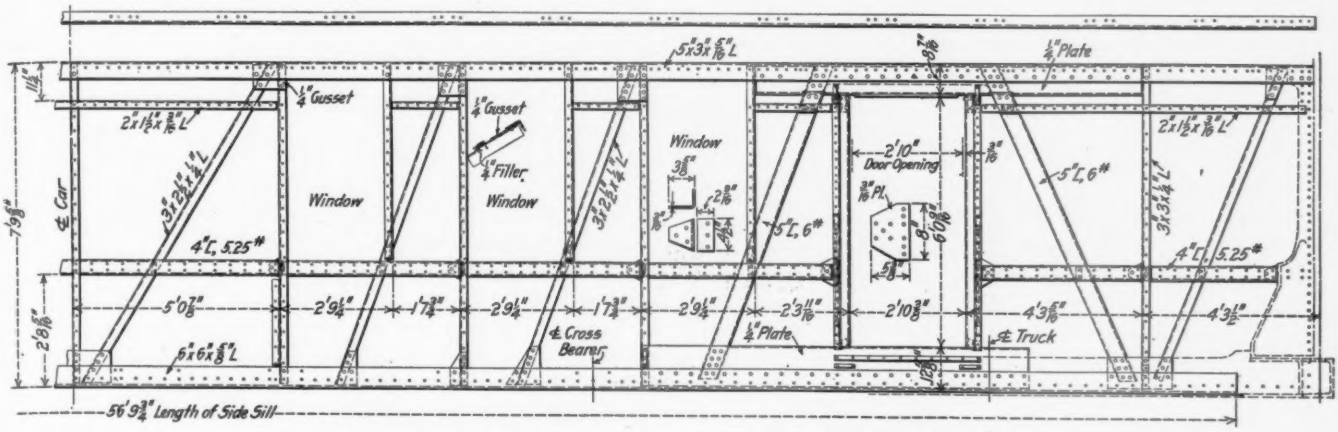


Interior of Wabash Postal Car Showing Electric Fixtures and Excellent Natural Lighting.

wood, the lower course being yellow pine laid diagonally and the upper course maple, laid longitudinally. The wood floor rests on wood furring and is bolted through the lower floor sheet to the Z bar floor supports. The hair felt insulation is placed between the furring and above the steel plate.

continuous, but is arranged in sections between the vertical posts to which they are securely fastened.

At the door opening the full strength of the truss is maintained by the addition of a 1/4 in. plate reinforcement at the top and bottom and the use of 5 in., 6 lb. channels as the

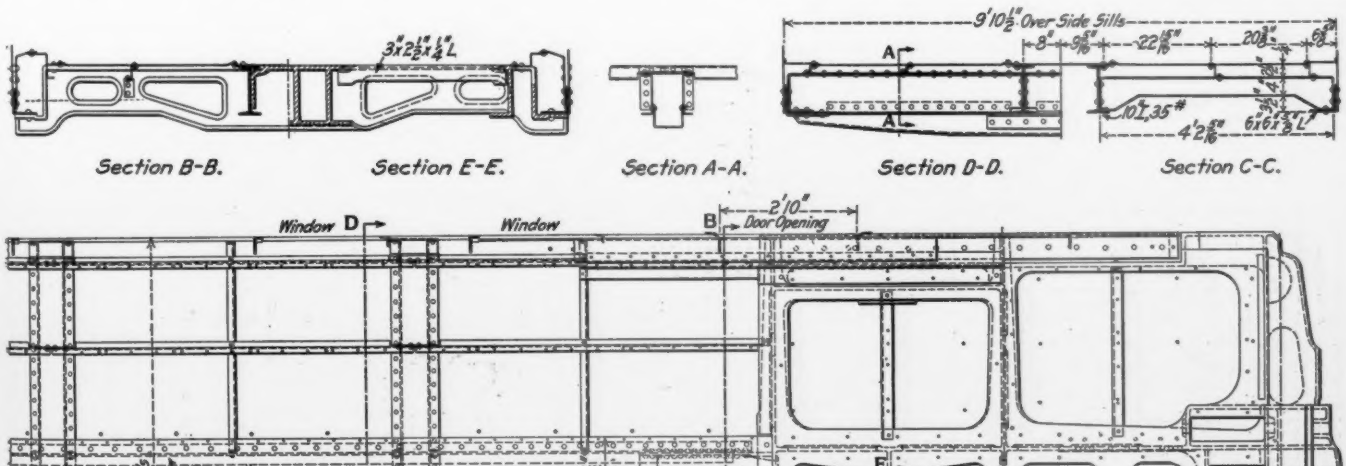


Side Framing of Sixty-Foot Steel Postal Car; Wabash Railroad.

The side frame truss occupies the full height of the car and is composed of a 6 in. x 6 in. x 5/8 in. angle side sill as the lower chord and a 5 in. x 3 in. x 5/16 in. angle side plate as the upper member. Between these are the vertical side posts which are 3 in. x 3 in. x 1/4 in. angles and the diagonal trusses of 3 in. x 2 1/2 in. x 1/4 in. angles which are continuous

diagonal braces on either side. It will be noted that special attention has been given to secure fastening between the various members and a 1/4 in. gusset plate of ample area for allowing enough rivets to develop the full strength of the section is found at practically every junction.

A steel casting manufactured by the Commonwealth Steel



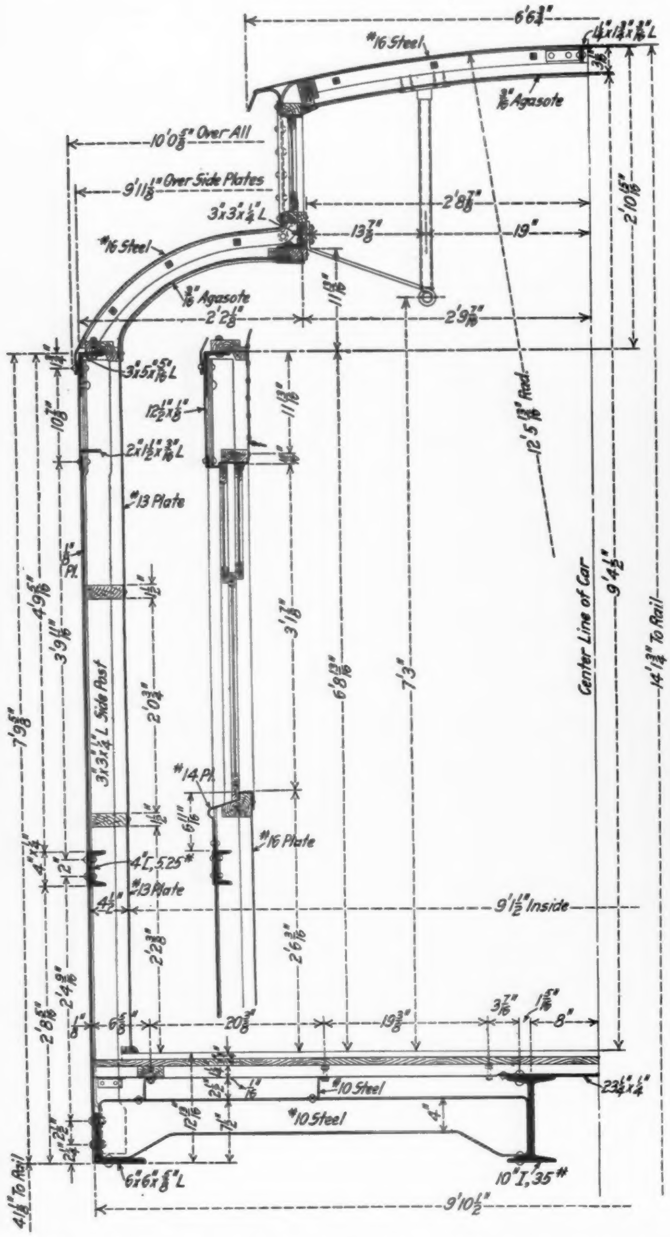
Underframe of Wabash Steel Postal Car.

between the upper and lower frames and are arranged as is shown in one of the illustrations. The side posts and diagonal braces are further stiffened and tied together by the 4 in. channel which acts as a belt rail. This member is not

Company includes the whole of the end framing. This has a broad bearing on the side and is machined and fitted to the combination underframe casting. It is arranged for great strength in a longitudinal direction and in addition to the

corner posts and the door posts has an intermediate vertical member on each side. All of these posts are designed in a general I-beam or channel section and give exceptional rigidity and strength. The sheathing of both the sides and the ends of the car is of 1/8 in. steel plate with butt joints, which are welded.

The roof is of the monitor type and is supported by 22 1¾ in. x 1¼ in. x 3/16 in. angle steel carlines running continuous between side plates to which they are connected with malleable iron knees. The upper deck roof sheets of No. 14 steel are riveted directly to the carlines and extend out over



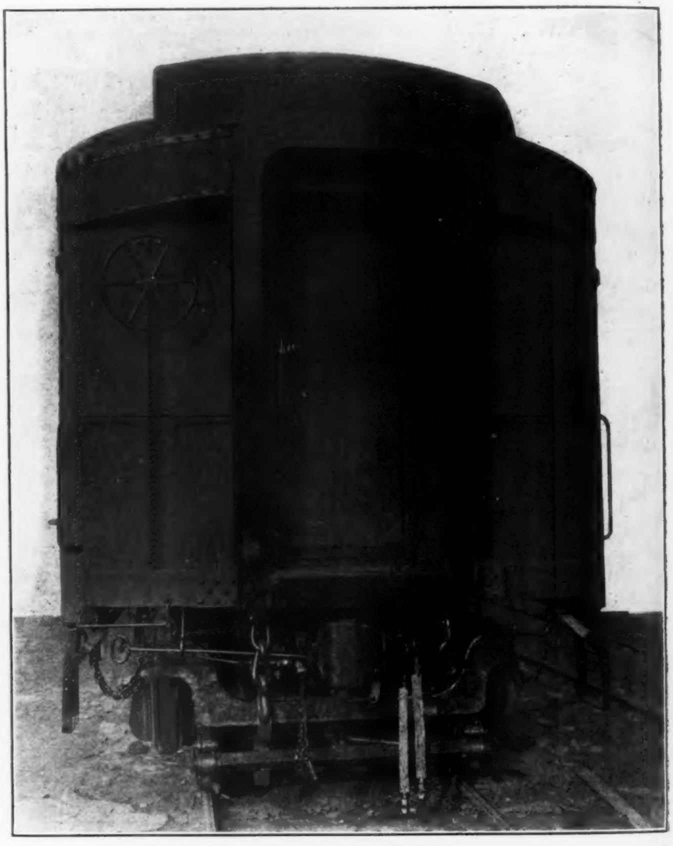
Section of Car Showing Arrangement of Longitudinal Members of the Framing.

a deck moulding of 3/16 in. pressed steel in an inverted U-shape. The lower deck roof sheets are No. 16 steel, riveted directly to the carlines, and extend over the sheathing at the side plate angle.

The inside finish is of flat steel plates, No. 16 gage for the sides and ends except at the storage part of the car where No. 13 gage steel is used. The upper and lower decks have a headlining of 3/16 in. agasote, screwed to wood furrings on the carlines; the joints are covered with flat wooden bands. The inside of the car is painted with a light enamel paint. The sash and doors are of ash, having the standard hardware of the builders with the polished bronze finish.

Insulation in the sides, ends and roof of the car is furnished by ½ in. Salamander applied against the outside plates and held in place by wooden strips nailed to wooden furrings. In addition, the inside face of the shell of the car has a thick course of ground cork glued to its surface. The installation of the floors is ¾ in. hair felt.

Positive ventilation is secured by eight Utility exhaust ventilators, four on each side, applied to the upper deck piers between the deck windows. These are provided with shutters so that the ventilators can be rendered inoperative at will. For the intake of fresh air, six swinging deck sash, three on each side, are provided. These deck sash openings are fitted with copper screens. The Safety Car Heating & Lighting Company's Thermo jet system of steam heat is applied and uses four lines of 2 in. pipe on each side of the car between the side doors. Beyond the side doors two lines



The End Frame of the Wabash Car Is Cast Steel.

of pipe extend halfway across the ends of the car; the pipes are protected by No. 16 perforated steel shields.

For lighting purposes the cars have been fitted with the Gould axle light equipment, using a 30 volt circuit and Gould storage batteries of 16 cells. The system of lighting is of the condulet type, having exposed conduits extending through the center of the car with condulet fixtures for 15 center lights, eight bracket lamps at the letter cases and one bracket lamp at the lavatory. Fifteen watt Tungsten bulbs are used. As auxiliary lighting there are 24 candles provided. The skylight in the center of the car in the upper deck provides 5 sq. ft. of lighting space. Galvanized iron letter cases and paper boxes are installed in accordance with the department specifications.

The trucks are of the railroad company's standard six-wheel type having 5 in. x 9 in. journals and Commonwealth cast steel frames.

Some of the specialties used are as follows: American Car

& Foundry Company's twin spring draft gear; Chaffee centering device; National couplers; Curtain Supply Company's 6 fold diaphram; Standard Steel 37 in. rolled steel wheels; Hewitt Manufacturing Company's journal bearings; Waycott brake beams; Streeter steel back brake shoes. The cars have a total weight of 124,300 lbs., of which the trucks give 42,000 lbs.

PROPORTIONS AND INSULATION OF REFRIGERATOR CARS*

BY M. R. PARKS,
East Rochester, N. Y.

There are various kinds of refrigerator cars used for the transportation of perishable products and the necessity for increased efficiency has been felt by the railroad companies handling this equipment. Many shippers have claimed that due advance has not been made in the construction of refrigerator cars to keep pace with the general refrigerating cold storage plants and refrigerating engineering of the day. Many of the older cars were lacking in insulation, which is the main feature, and have also lacked in ice capacity. However, the service demands for refrigerator cars have increased so rapidly that it has been impossible to do much more than give the added equipment necessary attention rather than to attempt to rebuild the older. The refrigerator cars used by the various railroads differ considerably in construction and in a greater degree as to the insulation. The cars vary in efficiency because of the light construction and insulation, or because of a variation in the insulating material itself. Knowing the faults of the older refrigerator car has stimulated thorough and thoughtful consideration and study along the lines of increased efficiency.

DIMENSIONS AND PROPORTIONS.

It is only within the past few years that substantial accord has been reached in the principles underlying the best practice in the development of the refrigerator car. It must not be supposed that there is entire unity of opinion existing among the engineers and manufacturers in connection with this particular class of car construction and it can be plainly stated that the opinions held and the individuals holding them may be broadly divided.

The history and development of the refrigerator car is an excellent guide to the manufacturers and operators in adopting a car with standard dimensions. It can be universally stated that the disadvantages resulting from the existence of numerous types and sizes of cars, place the shipper at an inconvenience. As some of the cars may be lighter or heavier than others, it is naturally a question as to which standard is right.

The most modern refrigerator cars in service, and in fact, nearly all which are being built at the present time that are used in the dairy business, are governed almost entirely by the size of the egg cases, this being the only uniform commodity used in carload lots which practically affects the dimensions of the car. The cases being 12 in. square and 26 in. long, the refrigerator car has developed to a point where for a carload lot, about 800 cases of eggs can be loaded. The railroad systems, without any concerted action, have arrived at a car which has inside dimensions of about 8 ft. 2 in. to 8 ft. 4 in. in width, and about 7 ft. 6 in. in height, and practically 33 ft. 0 in. between ice tank bulkheads. The car with these dimensions will take fifteen egg cases in length and will allow for seven tiers to be loaded in height, allowing for sufficient space for the circulation of air over the top tier. With a car of the inside dimensions noted, the length over the end sills would be 41 ft. 4 in. to 41 ft. 5 in. Inasmuch as these dimensions have been arrived at by each road, independent of the other roads, it would appear that they more nearly meet the general traffic conditions today than any other dimensions.

It is evident that the adopting of a uniform standard for refrigerator car conditions by the railroad systems will be a great benefit to both the shipper and manufacturer. This standard should be based upon experience, not only by the shipper, but by the railroad system supplying this particular class of cars. A purely theoretical standard which does not take into consideration all the conditions necessary to meet the requirements of the shipper would obviously be of little value. It is well known that one of the main essentials in the construction of a car of this type is the capacity of the ice tanks. The modern car has ice tank capacity ranging from 10,000 to 12,000 lbs. of lump ice. This capacity seems to meet the traffic requirements and the theoretical refrigeration required for a car of the dimensions described herein. In the construction and capacity of the tanks, the amount of refrigeration required depends upon a two-fold basis: first, refrigeration required to replace the loss through transmission of heat from the exterior; second, the amount of refrigeration required to quickly cool the contents of the car and to maintain as uniform a temperature as best adapted for the various kinds of produce handled. In the first case, the loss through transmission can only be governed by the thickness of the walls and the insulation so that the heat leakage will not exceed 2 B. t. u. per hour per square foot of surface for 1 deg. difference in temperature Fahrenheit, and the refrigeration for the produce based upon the specific heat at .8 units. These points are very important in the development of the ice tank and are taken into consideration in detail under the subject of insulation. There are no features in connection with these dimensions which do not meet the traffic requirements of all other loading. I think, therefore, that they may be considered as practically standard dimensions for modern refrigerator car equipment.

CAPACITY.

While many of the large railroad systems are continuing the practice of building refrigerator car equipment of the above dimensions with the standard M. C. B. 30 ton capacity trucks, the more generally accepted practice has been to increase the capacity of cars to 40 tons. In a number of instances, cars have been built with capacities ranging from 45 to 50 tons. The average refrigerator load, however, is so much below these capacities that it does not seem advisable to build a car with such large capacity with increased weight for the transportation of light dairy loads. The average dairy load is considerably under 30,000 lbs., and the capacity of the car, therefore, at 30 tons, is well within its limit. However, the general railroad equipment of the country has increased so in size and weight and the handling of the equipment has become so rough that it is almost necessary to build a car of larger capacity to stand the general service conditions now in vogue on most of the roads.

In a car built on 40 ton trucks, the weight of the body is so much heavier than the average freight car body that the usual 10 per cent. overload cannot be permitted; and, in the case of a 30 ton refrigerator car with a body of the above dimensions, the loading allowed would be limited to less than 60,000 lbs.; in both cases it is necessary to consider the ice in the capacity of the load. These limits are reached in the various capacity trucks by the M. C. B. rating for the carrying capacity on the axle. It can be readily seen that if the weight of the body increases, the load must in consequence be decreased.

INSULATION.

The efficiency of a refrigerator car, or its preservative features, depends chiefly upon the number of layers of insulation, its quality and thickness, the character of the workmanship in the construction of the car, the sealing of all parts, such as side doors, ice plugs and water traps so as to keep the interior temperature even without fluctuation. This efficiency, however, is

*Paper presented at the Third International Congress of Refrigeration, Chicago, September 15 to 24.

affected by the ability of the car to withstand the usual wear and tear while in service.

The insulation and ice tank work in connection with a refrigerator car makes it one of the most expensive of the common freight cars which the railroads operate. It costs more to build and more to maintain. In the building of new cars there is a decided tendency towards increased insulation. Cars are being built much heavier and much greater care is given to the selection and amount of insulation used in the construction. It was formerly considered good practice to use two courses of insulation with four courses of paper, but the design and construction of the later standard refrigerator cars has reached a point where four courses of insulation ½ in. thick are being used with eight and ten courses of high grade waterproof paper in addition. A decided departure from previous practice has been made with particular reference to the manner of application and increased thickness of the insulated walls together with the all important requirement of keeping the insulation dry. The importance of good insulation is well understood; perfect insulation is practically an impossibility. Generally speaking, the success and value of a refrigerator car rest primarily on a two-fold basis:

First, proper insulation to resist the exterior heat in summer, and to retain the heat and resist the cold at a low degree of temperature in the winter.

Second, ice tank capacity sufficient to provide adequate circulation of the cold air necessary for quickly cooling the contents of the car.

The more important of these principles of refrigeration is the insulation. The selection of insulating materials and the method of their application depend chiefly upon their insulating power. The insulating power of any material is its capacity to resist heat: or, in other words, the heat conducting or transmitting power, and this is a quantity of heat expressed by the number of British thermal heat units which will pass through a square foot of insulating material of a given thickness in one hour, or for 24 hours for a difference in temperature of 1 deg. Fahrenheit; or for a certain difference in temperature on each side of the insulating material. In addition to the non-conducting qualities, a good insulation must be clean, non-odorous, and non-decayable; it must resist every kind of decomposition, and have the greatest possible strength and durability together with properties making it easy to apply. Besides heat, water and moisture are two elements that enter into the selection of insulation. It is well known that one of the main essentials of economical insulation is dryness. Water is a good conductor of heat, and it is absolutely essential that the insulation be entirely and permanently waterproof. Waterproof does not mean merely resisting the entrance of water, but preventing its entrance. These points referring to the physical laws governing the transmission of heat must be given the fullest consideration in the selection of the insulating materials to be used. A refrigerator car being a movable object, it must resist all the rapid changes in weather and climate, and variations in temperature ranging from 40 deg. below zero to 120 deg. in the shade.

What constitutes adequate insulation is a question upon which a wide diversity of opinion exists among many refrigerator engineers. It is assumed to be the accepted practice in cold storage construction that the walls of the building be so heat proof as to keep from the interior all heat in excess of 2 B. t. u. per 24 hours per degree of difference between the outside and inside temperature. Assuming that the heat leakage in the modern cold storage plant averages 2 B. t. u., then the type of wall with material and character of insulation as applied to new and improved refrigerator cars as herein described, meets the necessary conditions surrounding that of a cold storage plant.

In determining the number of heat units of transmission through the wall consisting of a number of layers of insulation, the insulating power, or heat leakage, etc., can be readily calculated if the heat leakage, or conducting power and thickness of each of the individual constituents of such insulators are known. The heat leakage of the wall of a car insulated with four courses of ½ in. hair felt with the necessary waterproof paper and linings, theoretically averages about 4.35 B. t. u. per hour per square foot of surface for a difference in temperature of 52 deg. This difference in temperature has been based upon the exterior temperature of 90 deg. and the interior temperature of the car at 38 deg. Reducing the heat leakage to a 1 deg. difference in temperature between the inside and the outside would get approximately 2 B. t. u. for 24 hours per square foot of surface. The loss, however, due to the faulty construction and leakage through openings is not taken into account. These openings of necessity would materially increase the transmission of heat, but inasmuch as very little data is obtainable whereby this quantity could be determined, for all practical purposes when the heat leakage through the walls has been reduced to the basis of comparison with the walls of a cold storage building, it would seem to be satisfactory. The loss through the openings, such as side doors and ice covers can be greatly reduced by care in the construction of these parts and by the proper handling of them in service. This description of refrigerator car conditions is purposely brought out in order to make known the comparison between cold storage buildings and the modern refrigerator car; and that the refrigerator car herein described does meet, practically, the conditions required. This does not, however, apply to the various refrigerator cars in use today of the older type, as it is quite evident that many of them do not meet this standard of insulation, and it would be impractical to reconstruct them.

The first practical consideration being given to the thermal conductivity of the walls, the second most essential point is that the refrigerating capacity of the car must be great enough to replace the cold lost by transmission in the walls, ceiling, and floor, also the amount of refrigeration required to keep the contents of the car cold and at a temperature best adapted to the various kinds of fruit, produce, etc. The amount of refrigeration depends upon a number of circumstances: the size and construction of the storage, the amount and frequency of the products, their specific heat, and the mean external temperature, as well as the perfection of the insulation, and various other conditions. Assuming that the maximum temperature of the outside averages 90 deg. and the inside temperature of the car desired averages 38 deg., the range of temperature would be 52 deg; the exposed surface of the car being 1,600 sq. ft., the heat leakage at 4.35 B. t. u. per hour per square foot for a difference of 52 deg. then the amount of refrigeration required to replace the cold lost by transmission through the walls would be approximately 1,100 lbs. The amount of refrigeration required to replace the cold lost by transmission through the ceiling and walls being determined, it is necessary to calculate the amount required to cool the products in the car. Assuming that the specific heat of the different kinds of products is about .8 units, then the amount of additional refrigeration required to reduce the temperature of the products to that of the temperature of the car is equivalent to 4.39 tons (or 8,780 lbs.), based upon a load of 30,000 lbs. In the refrigerator cars now in service there are many ice tanks, patented and otherwise, aiming to assist the circulation of the air in contact with the ice. The amount of refrigeration required for the total number of cubic feet of storage is a point that has never been given the consideration that is absolutely essential for the proper cooling of the car and its contents. In many instances, refrigerator cars have ice tank capacity of only 5,000 lbs., quite a number of 10,000 lbs., and very few have been built with a capacity running as high as 12,000 lbs. Some refrigerator cars have been built with an air space entirely around the ice body which largely increases the radiation, and therefore the circulation.

In arriving at the quantity of ice necessary to transport most of the perishable products, the question of salting was not taken

into consideration. It is well known that with the use of from 5 to 20 per cent. of salt, a much lower temperature can be produced than the ice alone will give; and in the transportation of dressed poultry and fish, it is almost necessary to use a percentage of salt to secure a sufficiently low temperature to insure safe transportation.

RESULT OF M. C. B. LETTER BALLOT

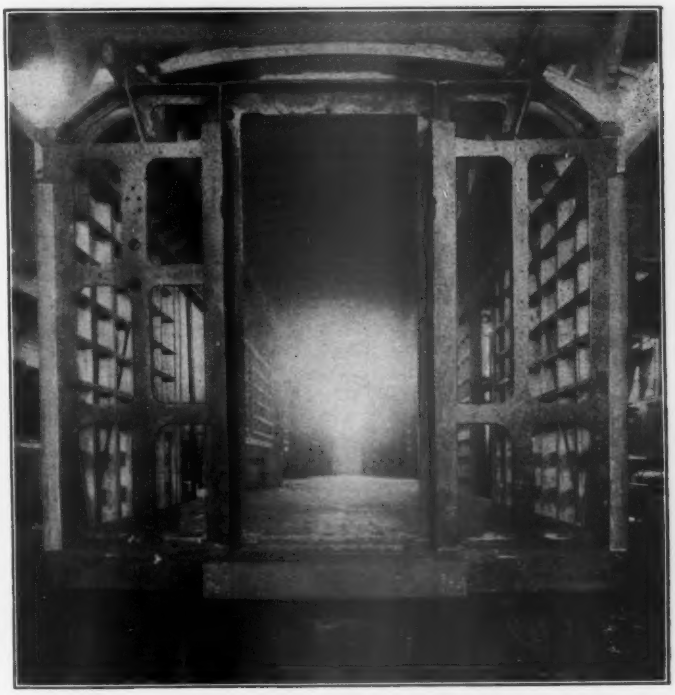
Voting by the members of the Master Car Builders' Association on proposed changes in the standards and recommended practice closed on September 14. There were 54 separate changes submitted for decision, of which 7 were changes in standards and 47 were changes in recommended practice. All of the proposed changes in standards were adopted and 35 of the 47 proposed changes in recommended practice were adopted, 12 being rejected.

The changes in standards are as follows: A change in the dimension of the hole in the lid for 80,000 lbs. and 100,000 lbs. capacity journal box; the advancing of the axle E with 6 in. x 11 in. journal from recommended practice to a standard; the spacing of brake beam heads as recommended by the committee (this makes the new average distance between the centers 60 in. with an allowable variation of ⅛ in. either way from this dimension). The details of brake beam gages as recommended by the committee have been adopted as standard and the coupler guard-arm test has also been restored. The wheel circumference measure for cast iron wheels as shown in Fig. 4 on page 1448 of the *Daily Railway Age Gazette* was adopted and the changes suggested in the report of the committee on loading materials, which is given on page 1475, were accepted.

All of the subjects recommended by the committee on revision of standards for recommended practice with one exception were adopted. These are given on pages 1433 and 1434 of the *Daily Railway Age Gazette,* the exception was the maximum side bearing spacing which the committee recommended should not exceed the rail gage with a minimum of 44 in. centers and a minimum clearance of 3/16 in. This was defeated. The committee on train brake and signal equipment recommended that all freight cars weighing between 37,000 lbs. and 58,000 lbs. be equipped with 10 in. brake cylinders, also that the braking ratio for freight equipment should be made 60 per cent. of the light weight of the car, based on 50 lbs. per sq. in. cylinder pressure. It was also recommended that the K-1 triple valve for 8 in. equipment and the K-2 for 10 in. equipment be adopted as standard. Further that no pipe having an internal diameter less than one inch and of standard weight should be used on passenger cars for brake pipe and that all new equipment should be provided with 1¼ in. extra heavy pipe. All of these, as well as the recommendation in connection with the position of bolting lugs of hose clamps were adopted. The committee's recommendation in regard to the use of galvanized brake pipe and fittings for refrigerator and coal cars was rejected. The recommendation of the committee on brake shoe and brake equipment in regard to brake beam No. 2 was rejected by a decisive vote. The three recommendations of the committee on car wheels referring to the specifications for solid wrought steel wheels, changes in illustrations of steel wheels and circumference measure for steel wheels were all adopted as were also the journal box, journal bearing, journal wedge, journal-box lid and other parts including the gages for the 6 in. x 11 in. box. Of the recommendations of the committee on train lighting which are given on page 1483 of the *Daily Railway Age Gazette,* the proposed axle for dynamos, recommended dimensions for battery box and a hanging recommended for the battery box were rejected. The other recommendations of this committee were adopted. The specifications for steam heat hose which were given on page 1484 were adopted, as were also the steam hose couplings. The recommendations of the committee on unloading machines were approved with very little opposition. The recommendations of the committee on car construction with a single exception were all rejected; the one adopted refers to the arrangement and use of end doors. The report of this committee will be found on page 1512 of the *Daily Railway Age Gazette.*

SPECIAL BAGGAGE CAR FOR SCENERY

A recent order of five baggage cars built at the Elizabethport shops of the Central Railroad of New Jersey included two special cars arranged for carrying scenery. The three ordinary baggage cars are 60 ft. in length and are mounted on four-wheel trucks. The scenery cars are 72 ft. long and are carried on six-wheel trucks. In both cases the cars are of composite design, with a very substantial steel underframe and a wooden superstructure with the exception of the ends. In the case of the 60-ft. baggage car, the end framing is all one large steel casting, with a door opening in the center and ribs arranged as shown in the illustration. This is sheathed with steel on the outside. This casting has a broad base at its connection to the side sills which is seated in a machined recess in the combination underframe casting, and makes a most substantial structure at this point. In the scenery car the same general scheme is carried out

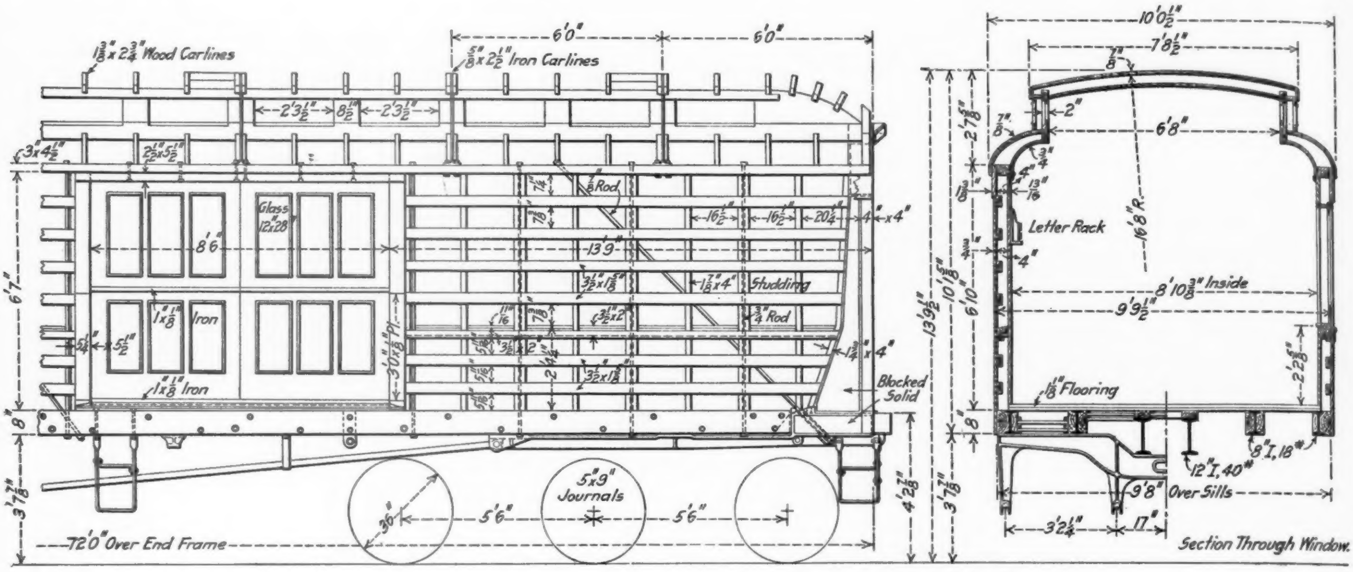


Cast Steel End Frame of Baggage Car.

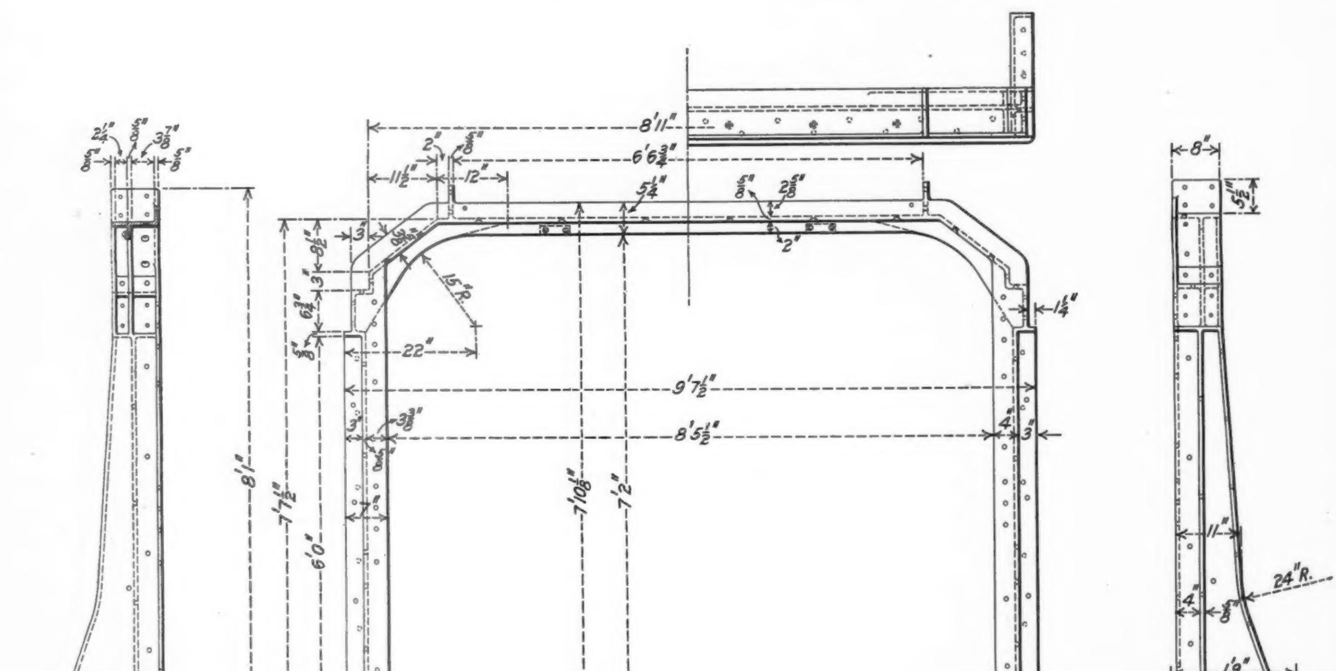
but, owing to the fact that it is necessary to have an opening for the full width at the end of the car in order to introduce the lading, the casting in this case takes the form of a large frame, the details of which are shown in one of the illustrations. Inside of this frame are a pair of doors formed of ⅜-in. steel plate, most securely braced and stiffened by steel angles and backed with wood lining. These large, double doors are so designed as to leave the single center door opening in the ends of the car and are provided with suitable locks at the top and bottom which, combined with the three heavy cast steel hinges on either side, form a most solid and satisfactory end for the car. A detail of this door is also illustrated herewith.

There is comparatively little difference in the design of the underframe of the two types of cars with the exception of the center sills which are somewhat larger in the case of the 72-ft.

car than in the shorter design. The underframe of the former consists of Commonwealth combination double bolster and end sill castings of special design, which are connected by two 12-in., flanges of the sills on both sides. There are four 1¾-in. truss rods pinned in seats in the casting at either end, being spaced and arranged as is shown in the section of the car. The side



Partial Side Elevation and Sections of Scenery Car; Central Railroad of New Jersey.



Details of Cast Steel End Frame; Central Railroad of New Jersey Scenery Car.

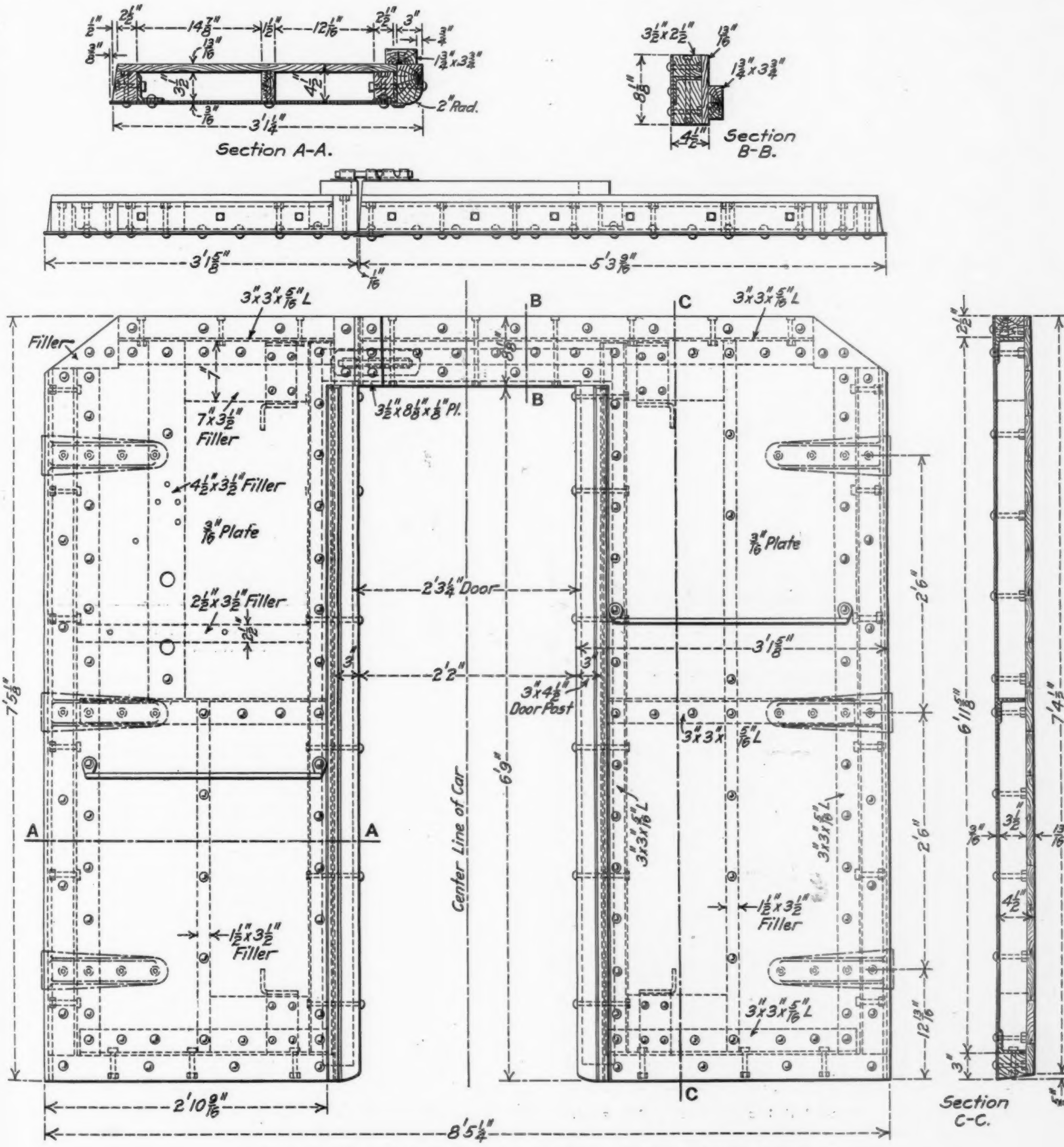
40-lb. I beams as center sills. There is a 5/16-in. cover plate running the full length of the I beams and lapping over the joints of the end castings. This plate is double riveted to the and intermediate sills are 8-in., 18-lb. I beams, which pass over the top of the end casting and are continuous between end sills. The arrangement and form of the cast steel cross bearers is also

clearly shown in the illustration and it will be seen that these pass under the longitudinal steel members of the frame. The arrangement and construction of the superstructure in general follows the usual practice for this type and size of car and provides for an 8-ft. 6-in. door opening on either side near the ends and 5-ft. doors on each side and opposite the larger doors.

The arrangement of the brake wheel on the end of the scenery car requires special provision since the wheel is located on the swinging door. The arrangement provided is for a hand wheel on the inside and outside of the door, and a split link in the hand-brake chain near the bottom of the door, so that it can be disconnected when the door is to be swung open. This split link is conected to the main chain by a smaller chain, and there is a bar across the end link of the disconnected bottom portion which prevents it from sliding through the shive at the end sill. Provision is also made for removing the hand wheel if it is necessary to give the desired clearance.

The locks holding the big double doors at the end have been given special attention since they are to hold the whole end of the car in its proper location against the possible shifting load. They are of the bolt type, passing through a heavy plate at the bottom of the door and behind a substantial lip on the end frame casting. Coil springs are arranged to hold them in the seated position and a suitable latch is included so that they can be held in the unlocked position when the doors are being swung open.

Gould side unlocking couplers are used, and since the uncoupling apparatus must entirely clear the swinging doors, it is



Steel Doors in End of Scenery Car; Central Railroad of New Jersey.

located under the end sill and operated by a direct pull on either side. The rod on the opposite side of the coupler from the unlocking lever passes over the coupler shank and continues by means of a chain around a shive and connects to the rod on the other side, which is fastened directly to the coupler lock.

The six-wheel trucks have a cast steel frame. They are provided with clasp brakes designed and manufactured by the American Brake Company.

These cars have a capacity of 60,000 lbs., and will be used for shipping automobiles and for baggage when not employed for their special purpose of carrying scenery. They have a light weight of 117,200 lbs., an inside length of 71 ft. 4 in., and an inside width of 8 ft. 11 in. The height on the inside of the car is 7 ft. 3 in.

Among the specialties are Minor Tandem Spring Draw Gear, Gould couplers, Ward steam heat, Pintsch gas lighting and Commonwealth steel bolsters. They were designed in the mechanical engineer's office of the Central Railroad of New Jersey.

AIR BRAKE HOSE LABEL

BY J. S. SHEAFE,
Engineer of Tests, Illinois Central, Chicago, Ill.

If a certain brand of air hose is known to give so many months' service, it should be removed at the end of that time. The impracticability of car inspectors continually examining hose labels is at once evident. One of the illustrations shows the dangerous position necessarily assumed by a man in order that he may read the present label showing the date of manufacture, and after he has read it he must calculate mentally whether or not the hose has reached the removal age.

In Reading the Present Hose Label a Man Occupies a Dangerous Position.

One way to insure a hose being removed after a given time is to have figures vulcanized on the outside, and near the coupling end, to show the month and year in which a hose will have reached its allowable maximum age. The hose shown in the other illustration was made in August, 1913, and should not remain in service after February, 1916, as shown by figures legible from outside the rails. A car inspector would remove this hose from service when the time had expired, and as he could easily tell this without any effort on his part, there would be no opportunity for the hose to remain on a car until so deteriorated that bursting under train line pressure would be inevitable.

Failure from mechanical injury may cut short the life before the hose has deteriorated to a sufficient extent to become dangerous. Only two things will minimize liability to accident with the better quality of hose: (1) Prevent failure from mechanical injury as much as possible; (2) Show legibly on the hose the date when it should be removed on account of age.

Hose So Labeled That the Removal Date May Be Read from Outside the Rails.

PROPOSED NEW SUBWAY CAR

A wooden full-sized model has recently been completed of a proposed subway car for the New York Municipal Railway which is to operate part of the subways now under construction in New York City. This car has been designed with the idea of facilitating the handling of large crowds, of increasing the proportion of seated passengers during the congested periods and to increase the capacity of each train.

The new cars are 67 ft. in length and have maximum width of nearly 10 ft. as compared with 51 ft. 5 in. length and 8 ft. 8¾ in. maximum width of the present Interborough subway car. They have six door openings in each side, each being 2 ft. 8 in. in width. These are arranged in pairs, one pair being at the center of the car and another at approximately one-quarter of the length of the car from either end. There are no side doors at the extreme ends of the car. The car is arranged to give a seating capacity for 78 passengers when all twelve doors are in operation, and will seat 90 passengers when but one door in each pair is in operation, and 98 passengers when but one door on each side is in operation. Of the 78 passengers seated during rush hours, 44 are provided with cross seats. The seats are arranged to allow ample open space around each door.

The cars will be of all-steel construction and will all have motor trucks. The estimated total weight of each car is slightly less than 122,000 lbs.

NEW DEVICES

MUD RING AND FLUE SHEET DRILL

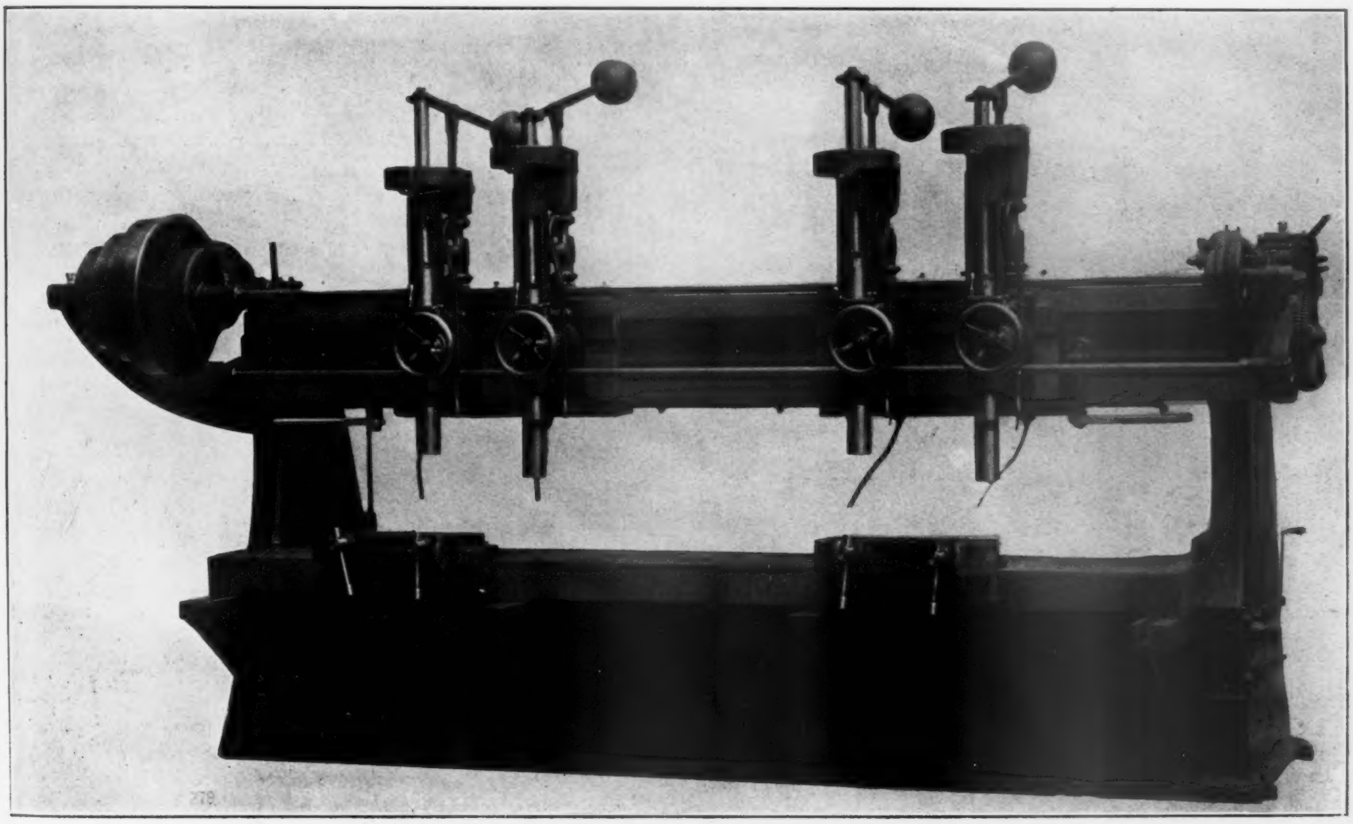
The four-spindle drill illustrated herewith, has been designed by The Foote-Burt Company, Cleveland, Ohio, for use in boiler shops for drilling the rivet holes around a mudring and for cutting out the flue holes in a flue sheet.

The spindles are the independent feed type, each one being arranged with automatic knockoff to the power feed. The quick return is made by a hand wheel on the front of the head. Each spindle is arranged with clutch for stopping and starting and has an interlocking mechanism so that the feed cannot be thrown in while the spindle is stopped or vice versa. With this independent feed feature some of the spindles are always drilling while the operator is setting the other spindles, so that the full efficiency of both the machine and the operator is obtained.

The spindles are arranged in pairs mounted on auxiliary crossrails and are adjustable on these crossrails to a minimum center distance of eight inches. The advantage of this feature is that it is possible to set the spindles to the proper spacing of the rivet or flue holes and then adjust two spindles along the main rail of the machine, maintaining the proper spacing and eliminating the necessity of spacing each one.

The spindles overhang the front edge of the base by eight inches to take care of the mudring work and the table is provided with chucks for holding the mudrings. The table has an in and out motion of 36 in. and is supported under the spindles by the bracket slides on the front of the base.

Three changes of power feed are provided, any one of which is available by shifting a lever at the right-hand end of the machine. Six changes of speed are provided by a three-step cone and throwout back gears. The machine weighs approximately 21,000 lbs.



Four Spindle Drill for Boiler Shop Work.

RADIAL DRILL OF HIGH CAPACITY

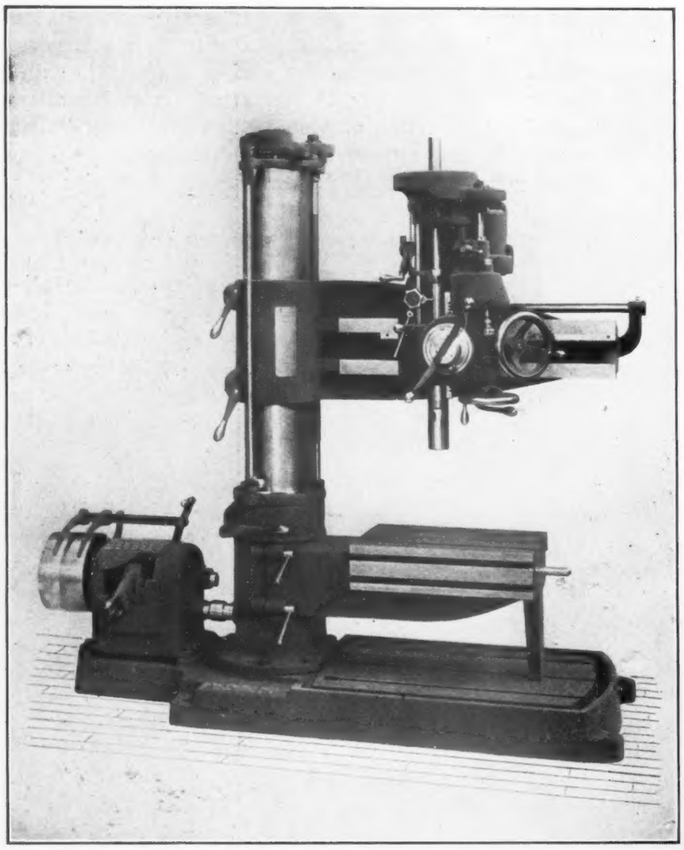
The 3 ft. radial drill shown in the illustration was designed for simplicity, accuracy and durability, and has ample power for the efficient use of high speed drills. It is self-contained, requiring no special foundation, and as no countershaft is required may be placed directly under the line shaft.

The base is very deep, of triple I-beam section to insure the greatest rigidity, and is well provided with extra large T slots. An oil channel is cast around the base draining into a large reservoir under the column, which is of the double tubular type. The fixed inner column is heavily ribbed and extends to the top, where a large ball thrust bearing insures easy swinging of the arm. The column is rigidly clamped by a convenient malleable iron lever which travels with it and is adjustable. The clamping surface of the column is large and is provided with means for taking up the wear.

The arm is of pipe section, well ribbed to give the greatest possible resistance to torsional as well as bending strain. The tighteners are equipped with adjustable screws to prevent sagging and provide means for taking up the wear. The elevating screw is suspended by a ball thrust bearing and the arm lowers at twice the elevating speed by a handle placed below for the convenience of the operator. Safety trips are provided for both

extremes. The head is easily moved along the arm by a rack and spiral pinion with the thrust taken up by a ball bearing in either direction. The back gears on the head give through hardened steel gears and clutches, three changes of speed, all made while running, by a single lever in front of the head. All gears are thoroughly encased and are placed between the spindle and the friction, giving the friction the benefit of the back gear ratio for the heaviest kind of work.

The tapping reverse frictions are simple and powerful. They are mounted on a sleeve which slides on the arm shaft allowing no grit to be drawn into the mechanism, which is enclosed and runs in oil. The adjustment for wear is made from the outside by a common screw driver. The spindle is of crucible steel and takes the thrust on a special ball bearing. The sleeve has a



Heavy Duty Radial Drill.

direct reading depth gage and the adjustable automatic trip may be set to the exact depth of the hole in any position. The safety trip is always positive at the extreme of the traverse. The quick return friction is large, may be instantly adjusted and is operated by a double lever. The pinion is hardened.

The feed changes are made while running, with but one handle, which has a direct reading index. The feed box is placed low on the head so as to give support to both sides of the worm. The worm wheel is enclosed and runs in an oil bath, and an overtake clutch permits the hand feed to be fed ahead of the power feed without disengaging the latter.

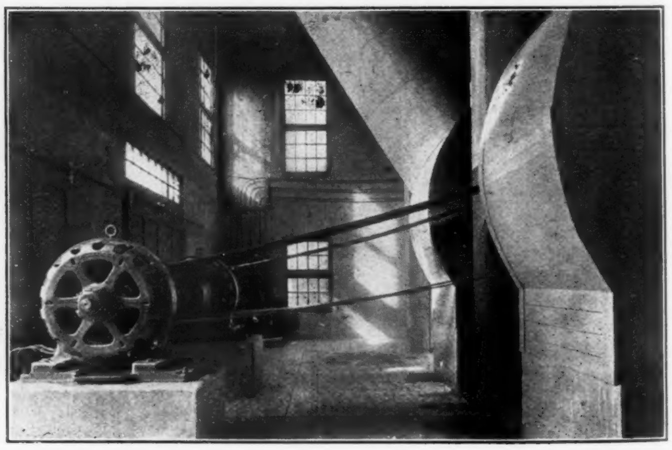
The speed box is simple and positive throughout and has a direct reading index plate for the positions of the lever. All the changes are made easily and noiselessly by a single lever and shock is avoided by an overtake arrangement which keeps the machine running at a reduced speed when the tumbler is out. A latch pin secures the tumbler and prevents chattering on heavy work. The lubrication system is very complete, oil chambers, felt wipers or pipes, as the location requires, being provided, and the bearings are of special phosphor bronze. Motor drive may be added to the machine at any time without special base or speed box, or it may be removed and belt drive substituted. Constant speed or 3 to 1 variable speed motors of any speed may be used and connected by rawhide gearing or silent chain.

The machine is manufactured by the Fosdick Machine Tool Company, Cincinnati, Ohio. The following are the principal dimensions:

Drills to center at base	72½ in.
Drills to center at upper column	76½ in.
Base to spindle, maximum	52½ in.
Base to spindle, minimum	13 in.
Base height	6 in.
Base working surface	41½ in. x 30 in.
Spindle to column, maximum	38¼ in.
Spindle to column, minimum	9½ in.
Spindle traverse	12 in.
Spindle diameter at point of drive	1 11/16 in.
Feeds (.007 to .031)	5
Speeds (25 to 400 r. p. m.)	18
Traverse of head on arm	28¾ in.
Travese of arm on column	27½ in.
Column diameter	10 in.
Face of arm	8⅛ in.
Table working surface	16 in. x 26 in.
Table height	18 in.
R. P. M., pulleys	360
Motor horsepower	3 to 5
Floor space	9 ft. x 7 ft. 6 in
Floor to top of column	6 ft. 11 in.
Floor to top of spindle	8 ft. 7 in.
Weight, net	4,200 lbs.

PRE-COOLING REFRIGERATOR FRUIT CARS

One of two sets of two 7 ft. Sirocco blowers driven by 75 h. p. Westinghouse motors, which are used by the Pacific Fruit Express Company, at Roseville, Cal., for cooling fruit cars previous to filling their tanks with ice, is shown in the illustration. Air is drawn from cooling rooms in which the temperature is kept at about 18 deg. F. by direct expansion ammonia coils, and is forced into the cars, reducing their temperature and effecting a considerable saving in ice during transportation. By means of specially designed valves, also driven by Westinghouse motors, the air current can be reversed so that the fans can exhaust foul air from the cars previous to the cooling



Motor-Driven Blower for Pre-Cooling Refrigerator Cars.

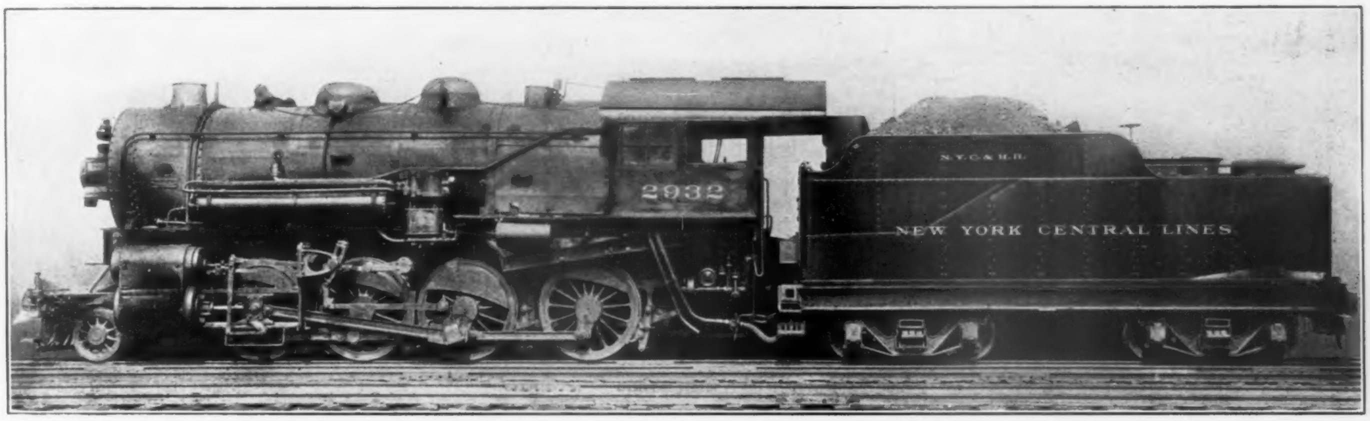
process. The electric motor drive is used extensively in this plant, being employed for the brine tank agitators, ice elevators, chain conveyors for loading and unloading, pumps and miscellaneous machines in the repair shop.

Refrigerator Cars.—According to a German paper devoted to the cold storage business there are in North America 100,000 refrigerator cars in service, besides 50,000 insulated and provided with special ventilating equipment. In the whole of Europe there are only 50,000 refrigerator cars of which 3,000 are on the Russian railways.

THE STANDARD LOCOMOTIVE STOKER

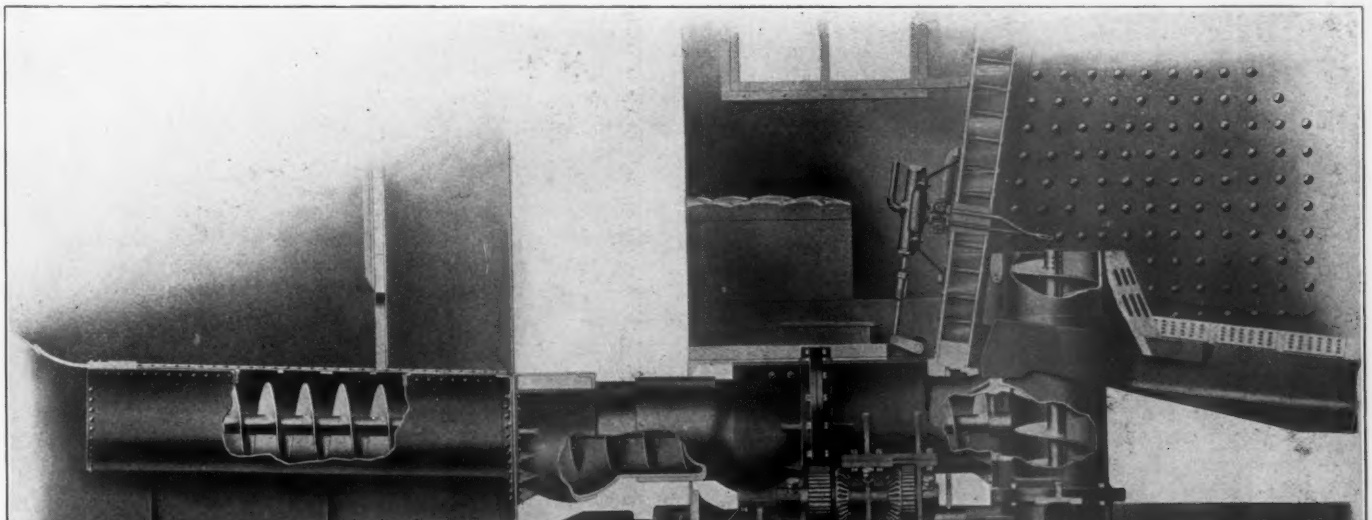
Scatter Type Using Horizontal and Vertical Screw Conveyor; Simplicity Prominent Characteristic.

In the Standard locomotive stoker a horizontal screw conveyor takes the coal from the tender and delivers it to a point under the center of the back mud ring of the firebox. Here it passes through a vertical screw conveyor which carries it upward and delivers it at a point about 12 in. above the grate level inside the firebox close to the back head. Steam jets on the ends of four pipes projecting through the back water leg at this point and having an intermittent action, distribute it from the top of the vertical conveyor to the various parts in the grate. The two screw conveyors and the valve controlling the duration of the steam blast in the jets, are operated through a simple gearing and an eccentric from a horizontal shaft extending across underneath the cab deck which, in turn, is driven through a worm and gear by a small engine secured to the outside of the frame under the cab on the left side. This engine is driven by steam and its speed is controlled by a valve located in the steam supply line at a point convenient for operation from the fireman's seat. Each of the four small pipes leading from the control valve to the steam jet is provided with a small globe valve by which the intensity of each jet can be independently controlled. These pipes are also capable of being turned from the outside so as to alter, to some degree, the direction of the blast. In a general way this covers the essential features of this new type of stoker which it will be seen is very simple in its arrangement, direct in its action, flexible of control, does not occupy any appreciable space in the cab and is still easily reached for inspection or repairs.



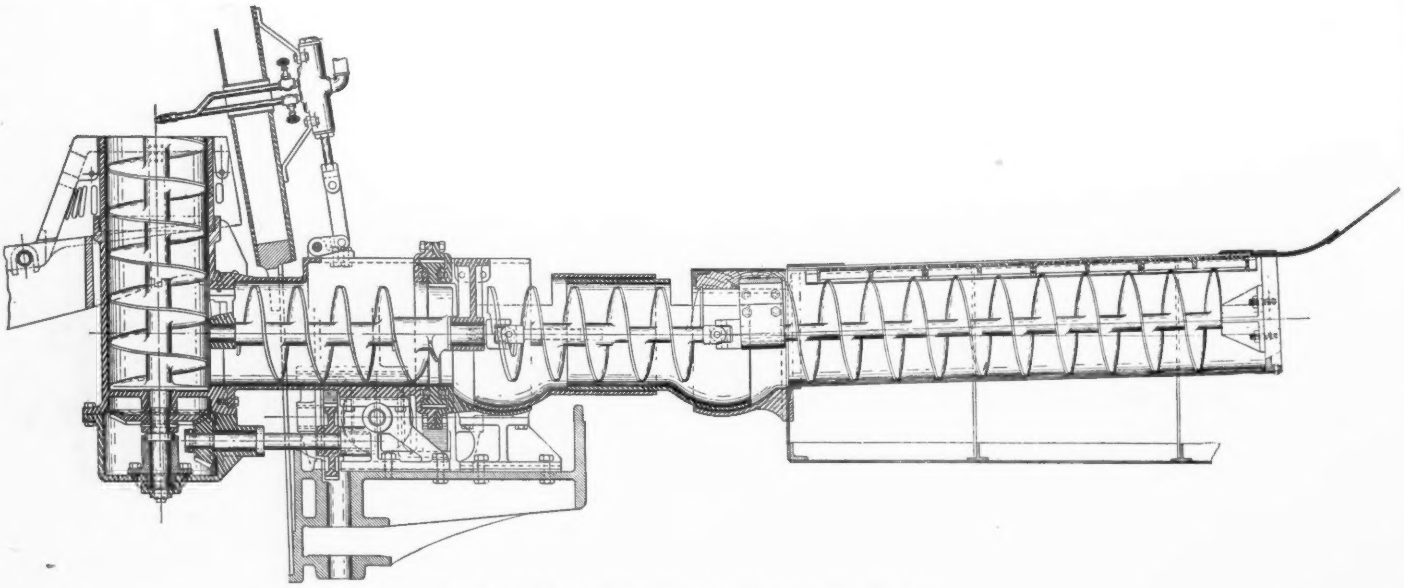
Consolidation Type Locomotive Fitted with a Standard Locomotive Stoker.

This stoker has been in use on a large consolidation type locomotive on the New York Central lines at Buffalo for over three months, and during this time has given 100 per cent. service continuously, although the locomotive has been in heavy



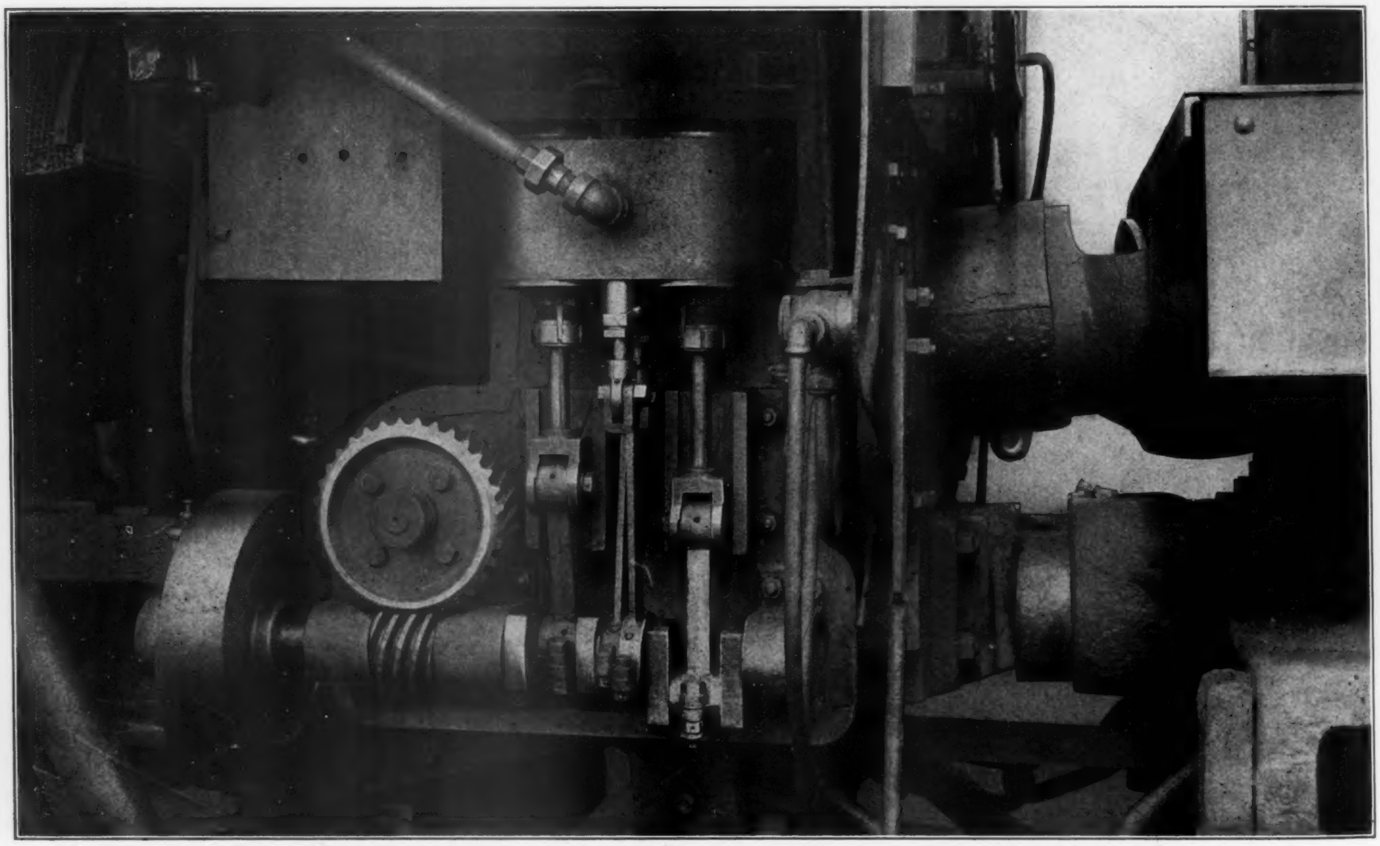
General Arrangement of the Standard Locomotive Stoker, Showing All Parts Except the Engine for Operating the Conveyors.

pushing and road service. Preparations are now under way for a very thorough and complete test of all features of the stoker. Observation indicates that, at the present time, the stoker uses somewhat less coal than is required on the same class of engine by hand firing, it makes decidedly less smoke than the hand fired engine and is fully capable of maintaining full steam pressure under severe conditions of operation.



Sectional View of the Standard Locomotive Stoker.

The section of the conveyor in the tender extends from the back slope sheet of the coal space to the front end of the tank. It is enclosed in a trough under the floor and is open at the top with the exception of a wrought iron grating with openings about 6 in. square for the admission of the coal. Above this grating are sliding steel plates in short sections which can be moved to permit the admission of coal at any desired point. The sides of the coal space are sloped inward to make the tender entirely self-feeding so that, except for pieces of coal which are larger than will pass through a 6 in. square opening, but little attention needs be given the feeding of the coal in the tender. This section of the conveyor is carried by bearings at the ends. It is made with a large steel shaft and separately cast steel spirals which are keyed to the shaft. The bearings at either end are lubricated with grease and, on account of the

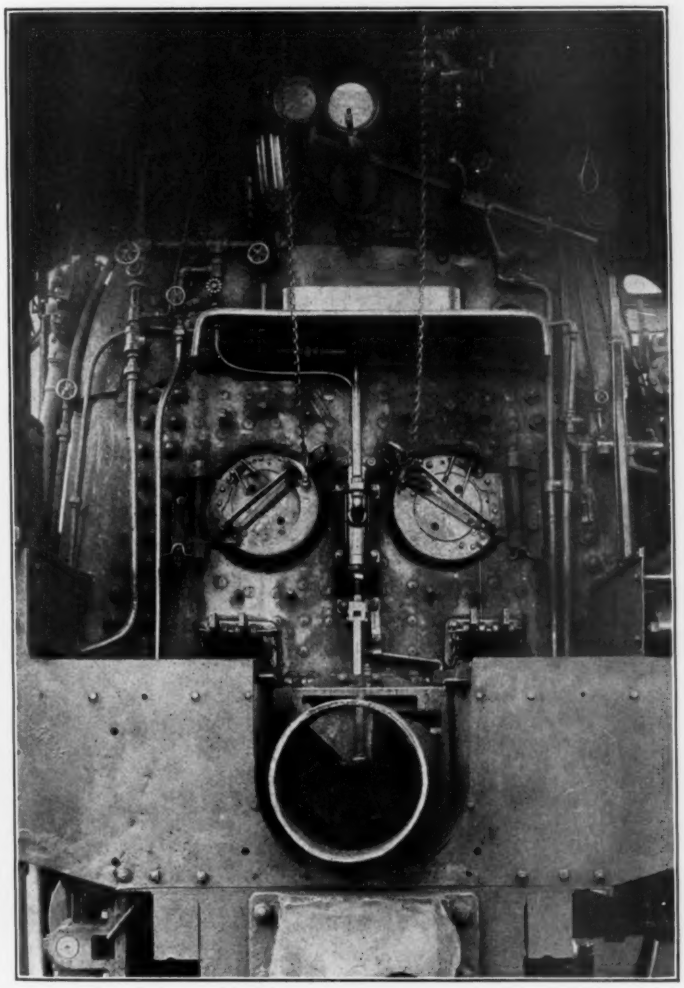


View Showing the Engine and Worm Gearing and the Flexible Connection in the Conveyor.

low speed will require the minimum of attention. Various diameters of conveyors are being experimented with at this time and the indications are that a 9 in. diameter will prove amply sufficient for handling up to 6,000 lbs. of coal an hour.

Freedom of movement between the engine and tender requires the use of a flexible conveyor section and this has taken the form of a double ball jointed section of the trough which also has a slip joint. A short section of the spiral is contained in this and is connected to the section on the tender by a universal joint and to the section under the locomotive deck by a universal as well as a square slip joint in the shaft. One of the illustrations clearly shows the appearance of this flexible section. In operation it is found that there is no trouble in passing the coal from one section of the spiral to another through the ball joints, nor has any trouble been found with the freedom of movement between these parts. The fine coal and dust which finds its way in between the moving surfaces form an excellent lubricant and these parts have a complete freedom of movement without oil lubrication. The universal joints in the shaft of the conveyor are made of forgings in the simplest form, are screwed directly on the end of the shafts.

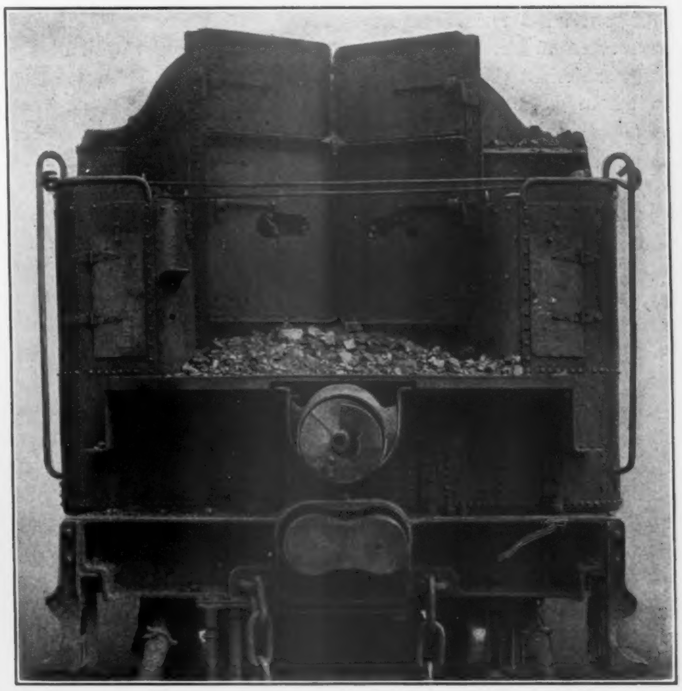
The short section of the conveyor under the locomotive cab



View in the Cab. The Jet Control Valve Is Between the Doors and Close to the Back Head.

deck is supported by bearings at either end and its casing is rigidly secured to the locomotive deck plate and to the casing of the elevating conveyor. It is partially open at the top, having a small trap door in the cab deck for inspection. The section of the casing extending under the mud ring, as will be seen in the sectional illustration, fits the spiral with only moderate clearance for the full circumference, and the last full spiral of this section becomes a feeding mechanism for the elevating spiral which of course, must be kept full of coal at all times. The bearing at this end of the conveyor is carried by a bracket from the top of the trough casing. This bracket is made as narrow as possible to give a minimum obstruction to the movement of the coal. The horizontal thrust of the different sections of this conveyor is resisted by large shoulders at each of the bearings.

The elevating spiral is placed in an exact vertical position



View of Tank Showing the End of the Conveyor.

and it extends from the bottom of the horizontal conveyor trough to a point about 12 in. above the level of the grate. This casing is also securely supported from the frame of the locomotive and is built with heavy rigid walls insuring its alinement and strength. For protecting the upper end which projects above the grate level, from the effect of the heat, a conical shape grate has been arranged which includes the top ring of casing and extends diagonally downward on the sides and in the front, allowing a free circulation of air around the casing. The bottom of this casing is made with a well that holds the lubricant for bevel gears by which the spiral is driven. The shaft has a long bearing above the gear and is supported on a ball thrust bearing. There is no bearing at the top of this conveyor.

A small two-cylinder reciprocating steam engine is at present used for driving the conveyors, although experiments are being made to ascertain the advantages, if any, of using either a turbine or more compact type of engine for this purpose. This engine, as at present operated, has a heavy flywheel at one end of its shaft and runs at about 160 revolutions per minute. It drives the horizontal shaft through a worm gear. This horizontal shaft is of large diameter and extends across the locomotive. It terminates in a bevel gear on the right end just inside the frame and is supported in bearings formed in the bed plate of the stoker, which in turn is supported from the deck casting and the frame. The large bevel gear meshes with two other gears. Both of these drive short shafts which have spur gears on the opposite end. The forward gear meshes with a gear on the shaft which carries the bevel gear for driving the elevating conveyor. The other spur gear meshes with and drives through a large gear on the horizontal conveyor. This gear is keyed to the section of the conveyor under the cab

deck, has its spokes arranged to form a part of the spiral of the conveyor and is so enclosed in the housing that the finest coal dust cannot reach the teeth. This housing is opened only at the point where the small spur gear meshes on the lower part of the right side and brass packing rings resting on coiled springs form sealed joints on the sides of the gear.

The jet control valve consists of a small casting containing a reciprocating valve and is secured on the boiler head between the fire doors. The valve stem projects through the bottom and is connected by a link through a rocker to an eccentric on the horizontal shaft under the cab deck. The steam supply line is connected to the center of the valve casing and a globe valve is provided in this line for controlling the pressure in the jets. A steam gage shows what pressure is being used. The valve is simply a hollow piston valve of the plug type with a connection to the steam supply at the center and a discharge from either end. As it is moved upward and downward by the eccentric it alternately opens a passage at the top and at the bottom which conveys the steam through a cored passage in the casting to an outlet leading to a pair of the jets. These jets are on the ends of $\frac{3}{4}$-in. pipes, of which there are four coming from the jet control valve and passing through a 3-in. tube in the back water leg. The nozzles are located at about the center and somewhat above the top of the elevating conveyor and are arranged in a form and direction to blow the coal in fan shape to different parts of the firebox. Small globe valves on each of these supply pipes permit the intensity of the different jets to be varied as desired.

Lubrication for all of the important bearings is provided by means of oil cups accessible from the outside of the locomotive while standing on the ground. The chamber underneath the vertical elevator, which contains the bevel gears, is kept filled with oil at all times, the filling pipe being continued to the right side of the locomotive just above the frame. Other bearings have either grease cups or oil holes which can be occasionally lubricated when necessary.

In operation, it has been found that the running of the conveyor when handling between 4,000 and 5,000 lbs. of coal an hour requires very little power. In fact, an estimate based on the speed of the small engine and the steam pressure, indicates that not more than 7 horse power is required for this purpose. The operation of the machine is remarkably noiseless and when the locomotive is in operation it is impossible to tell if the stoker is running or not except as observation is made of some moving part. In the case of the consolidation type locomotive on which the stoker is now being used, but one alteration was found necessary in the adjustment or arrangement of the locomotive. This consisted of enlarging the nozzle from $4\frac{7}{8}$ in. to $5\frac{1}{8}$ in. diameter. The locomotive is equipped with a brick arch and records have been made of the steam pressure during the past three months, readings being taken every five minutes while the locomotive was in operation, from which it is found that the average pressure for this time is 198 lbs., with the pops of the locomotive set to open at 200 lbs. It has been found that the distribution of coal over the grate is remarkably uniform and that the only necessity for using the rake occurs when there has been an unwise or too prolonged change made in one of the distributing jets which has supplied too much coal to a certain section.

The stoker is manufactured by the Standard Stoker Company, with offices at Grand Central Terminal, New York, and the du Pont, building, Wilmington, Del.

Seasoning Timber by Electricity.—In describing his latest researches on the electrical seasoning of timber, Dr. Nodon claims that his process can be applied in the forest where the trees are felled, since no cumbrous or costly equipment is required. The process depends on the electrolysis of cellulose and its derivatives.—*The Engineer.*

MAHR OIL BURNER

A new type of burner that has found extensive use on car repair tracks and in railway shops has recently been perfected and placed on the market by the Mahr Manufacturing Company, Minneapolis, Minn. An illustration of the equipment with its three nozzles is shown in Fig. 1, and the design of the nozzle is clearly shown in Fig. 2. The most marked results obtained from the burners in actual service have been in the repairing of steel car underframes and of steel cars. Reports from the users of this device have been very satisfactory, and in many cases incidents were mentioned where a considerable saving had been made by its use. On one large road several 100,000-lbs. capacity

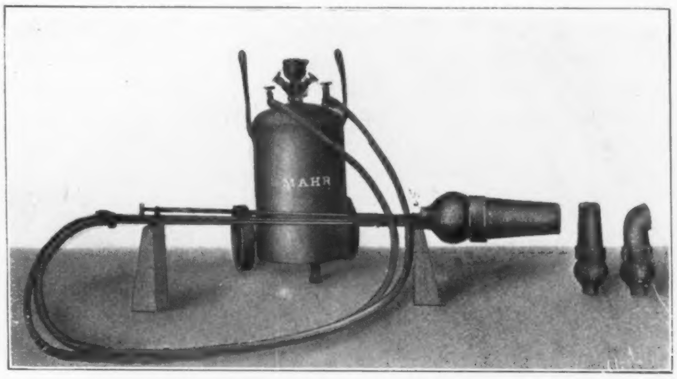


Fig. 1—Mahr Oil Burner for Car Repairs.

self-clearing hopper cars that had been badly damaged in a wreck and relegated to the scrap pile, were reclaimed with the aid of these burners and are now in active service. Fig. 3 shows one of these cars as wrecked, and Fig. 4 after it had been repaired. This was accomplished by heating the sheets and jacking them back into place, it not being necessary to cut the rivets during the work. The underframes of two cars which were badly damaged in a wreck were placed in good condition at a cost of $215 each, with the aid of this burner.

While the use of this burner in heavy repairs is successful, it

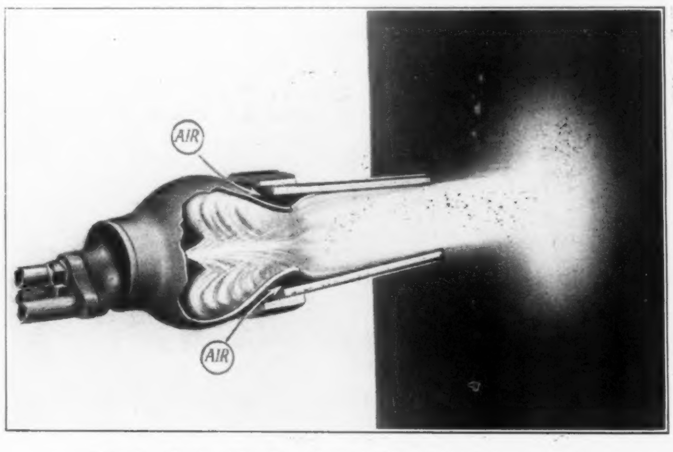


Fig. 2—Mahr Double Combustion Chamber Torch.

has found a still greater field in light repair work. With the ever increasing use of the steel underframe the slight repairs required by the car inspectors, such as bent end sills, bolsters, side sills, buckled sheets, etc., become an important and sometimes a costly factor in repair track work. With the aid of this burner such work is very quickly accomplished.

The elbow torch is readily used in heating the flanges of bolsters that have been damaged by shifting hooks, etc. One such piece of work was done in ten minutes by the ordinary repair track gang. The burner may also be used in close proximity to

the wooden structure of the car without injuring it in any way.

The burner may also be used in the shop in straightening axles. The axle is first heated and then bent straight by a jack; in one case worthy of note the work cost 20 cents. It has other uses throughout the shop, such as preheating locomotive parts preparatory to welding, bending and straightening, etc., making shrinkage fits, melting out bearings, heating bearings for babbitting, etc. In the boiler shop it is used for mud ring corners, flanging throat sheets, firebox door holes, annealing, etc.

The construction and operation of the burner is very simple.

Fig. 3—Hopper Car Damaged in a Wreck.

The tank is loaded with either crude oil or kerosene through the strainer at the top. The air pressure from the shop line is also admitted through this connection, two valves being applied for controlling these operations. The other two valves control the delivery of the air and the oil to the hose connections. The operator controls the intensity of the flame by the plug valve which is in the air line, and a needle valve for the oil, located at the burner but controlled through a long stem extending back to the end of the lead pipes. This permits of heating inaccessible parts of cars or locomotives without interfering with the operation of the burner. The construction of the burner is clearly shown in Fig. 2. The first chamber is so constructed as to choke

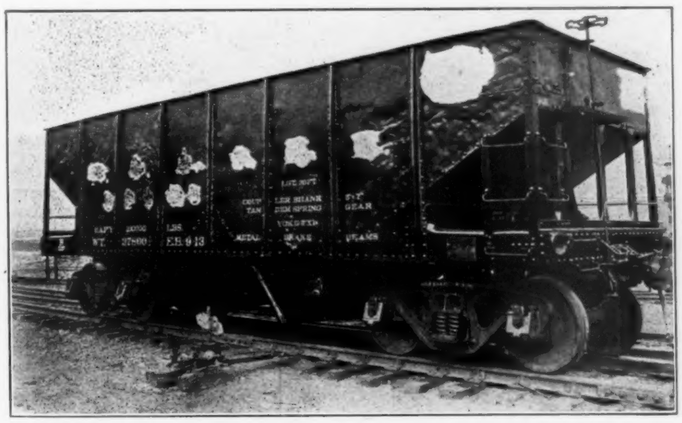


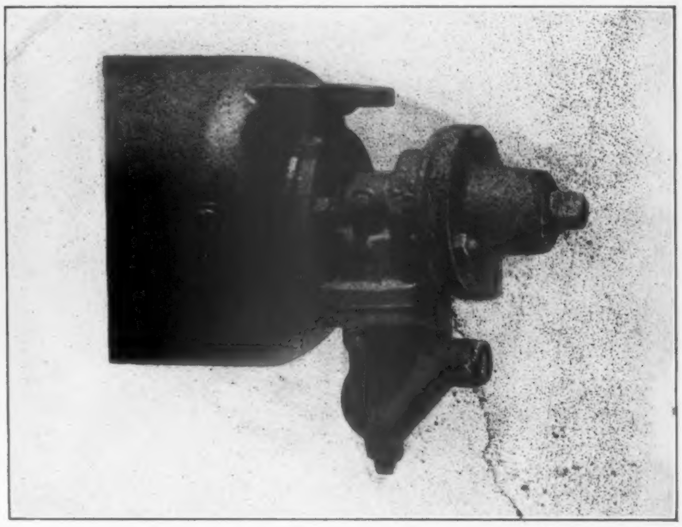
Fig. 4—Car Shown in Fig. 3 After Being Repaired.

the atomized oil so that it may be thoroughly ignited and on passing out of this chamber it draws more air through the auxiliary intake as indicated, which will complete the combustion of the atomized oil. Most any workman may be taught to handle the equipment in a short time.

The burner shown in Fig. 1 is specially designed for steel car work. The small straight nozzle and the elbow nozzle will heat an area 18 in. in diameter, and the larger nozzle, an area of 36 in. in diameter on a ⅝-in. steel plate in a few minutes. The tank has a capacity of 20 gals. The small nozzle will consume 6 gals. per hour and the large nozzle 9 gals. per hour. The weight of the entire outfit is 210 lbs. Smaller burners are also made for other classes of work, and a special torch may be had for removing paint.

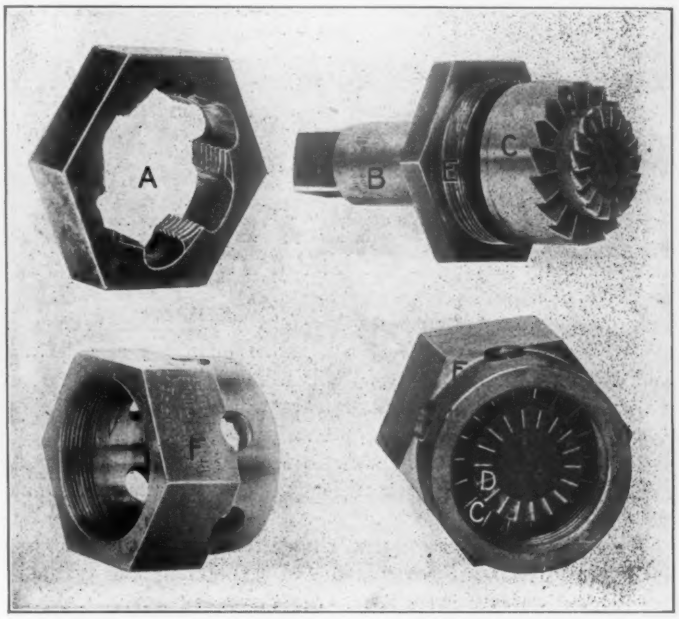
TOOL FOR REPAIRING TRIPLE VALVES

One of the accompanying illustrations shows a triple valve with the check valve case broken and the thread stripped at the branch pipe connection. Either of these defects would make this part worthless and would necessitate its being scrapped.



Triple Valve With Broken Check Valve Case and Stripped Thread.

In order to prevent this loss of material, a tool which is called the R. & G. Jiffy repair tool is being made by A. N. Rutan, 365 West Gray street, Elmira, N. Y., for repairing such defects. The parts and the assembled tool are shown in another of the illustrations. The die *A* is used for recutting the thread;

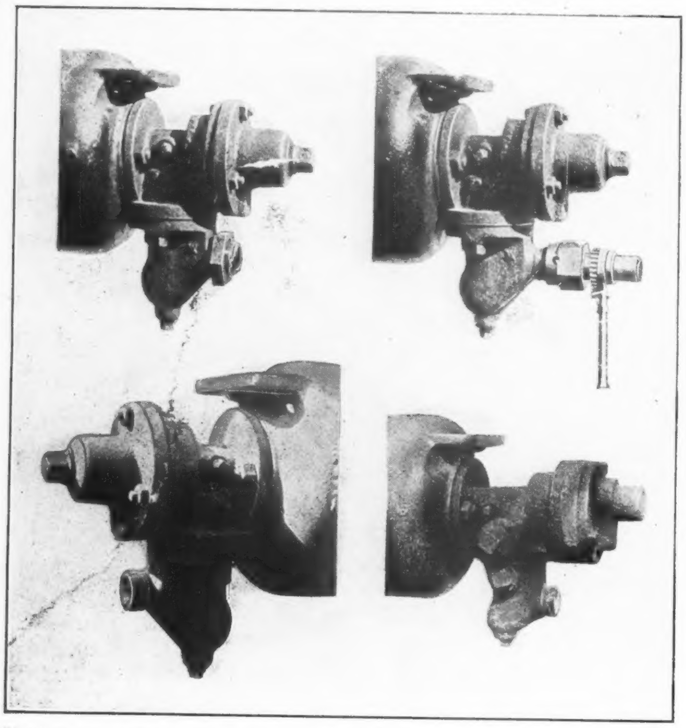


Parts and Assembly of the R. and G. Jiffy Repair Tool.

the shank of the tool *B* passes through the cap *E* and has secured to it a facing cutter *C* and a counterboring cutter *D*. The thread on the cap *E* screws into that on the body *F*, which in turn is screwed to the thread on the triple valve and steadies

the tool when it is being used. The holes shown in *F* are to provide a means of escape for the chips.

Another of the illustrations shows the tool in use and the results which can be accomplished by it. In the upper left hand corner is shown the die in use cutting new threads on the broken part. This die is made so that it can be easily and quickly operated under a car or in places where very little space is available. It usually takes about three minutes to cut the new threads. In the upper right hand corner the repair tool is shown in position after the threads have been renewed. The facing and counterboring of the damaged part are accomplished in one operation, the time necessary being from four to six minutes. In the lower left hand view is shown a West-



Method of Using the Tool, and Repaired Westinghouse and New York Triple Valves.

inghouse triple valve after repairs have been completed, while in the lower right hand corner is shown a repaired New York triple valve.

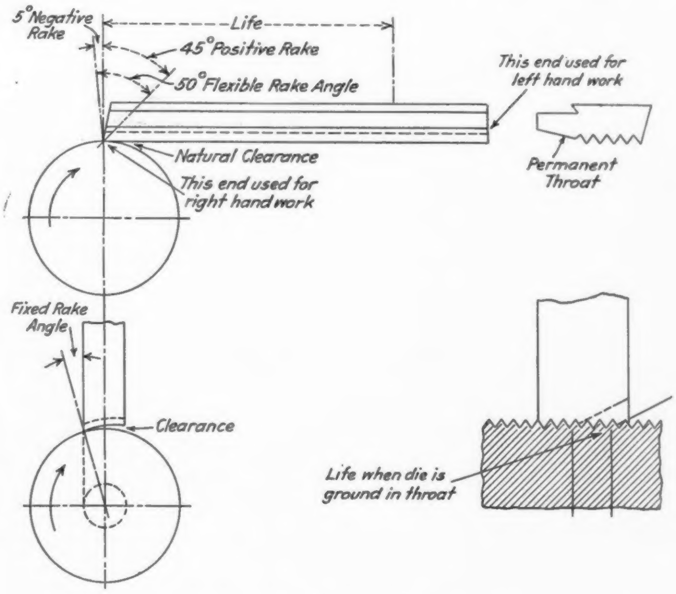
LANDIS STATIONARY PIPE DIE HEAD

A new stationary pipe die head that is simple in construction and is applicable to certain pipe machines of the rotating pipe type has been perfected by the Landis Machine Company, Waynesboro, Pa. A general idea of its operation may be obtained from the illustration. The head is composed of four major parts, namely, the head body which carries the chaser slides, the chaser slides, the operating ring, which imparts the oscillatory motion of the handle to the chaser slide, giving the chasers a universal radial movement to and from the center, and the chasers.

There are several important characteristics of this die. Its life is ten to twenty times that of the ordinary hobbed type die, due to the type of chasers used. Moreover, the line contact the chasers have with the work reduces the friction and permits of much higher cutting speeds. This increase in speed is augmented by the flexible rake feature, which makes it possible to obtain the best cutting condition and successfully thread all grades and kinds of pipe.

Since the lengths of thread on the standard sizes of pipe are fixed, a die that requires grinding in the throat is necessarily comparatively short lived, as a few grindings will cause the length of thread to fall below the standard. This objection is eliminated with this die, since the cutting contour is always the same, this being due to the fact that the chasers are ground on their inner ends and never on the bevel surfaces which form the throat.

As one set of dies covers the entire range on all sizes of standard pipe where the pitch is the same, it is unnecessary to



Graphical Comparison of Chasers for Pipe Threading.

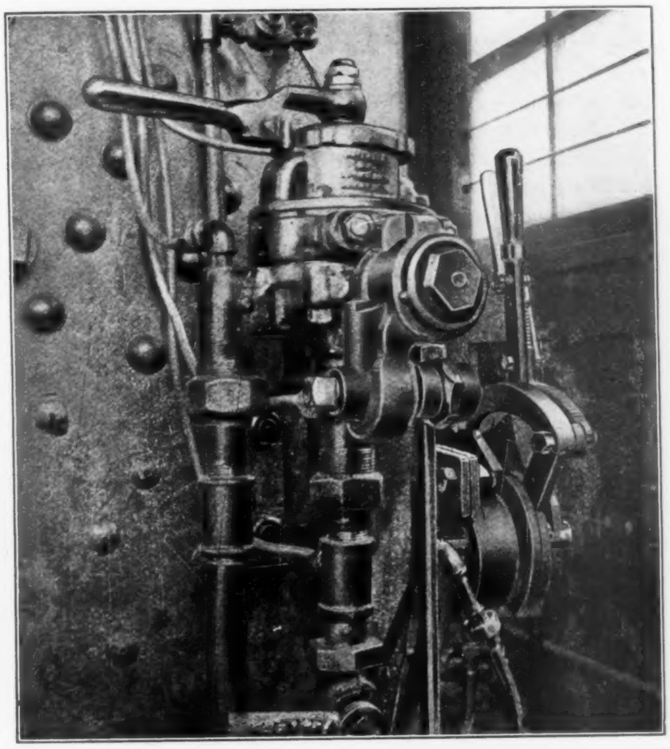
remove the chasers from their holders, except for grinding purposes. Their removal is accomplished by slackening the two chaser clamping screws on each holder just enough to allow

Die Head for Pipe Threading.

the chasers to be slipped from their seats. They are set to the proper position by bringing the cutting edges flush with the flat surfaces on the chaser slide provided for that purpose. A steel scale or straight edge will simplify this operation.

NEW POWER REVERSE GEAR

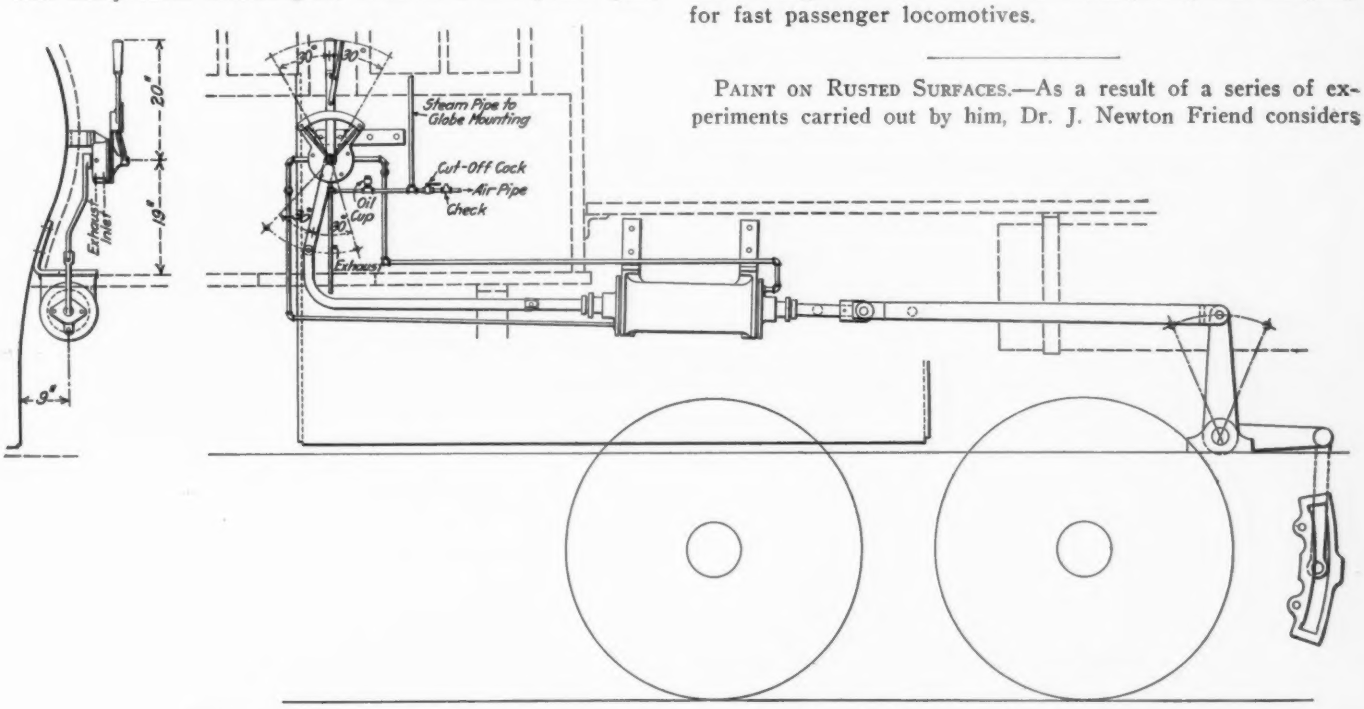
It is becoming generally recognized by railway men that locomotives in switching service, equipped with power reverse gear, can handle a much larger tonnage than those



Arrangement of Lever and Valve in the Cab.

without, and as an adjunct to the efficiency and comfort of the crew such equipment cannot profitably be overlooked.

The Casey-Cavin reverse gear, which is a new power gear,



Application of Casey-Cavin Power Reverse Gear to a Canadian Northern Switching Locomotive.

has recently been introduced by the Canadian Locomotive Company, Ltd., Kingston, Ont., and patents are pending in several countries. The illustrations show the general arrangement and also the controlling valve and lever in the cab. This application was made to some 0-6-0 type switching locomotives for the Canadian Northern.

The device consists essentially of a cylinder containing a piston, and rods so arranged as to shift the links or radius bars, and a valve containing two independently movable discs, one operated by the hand lever and the other by the connecting bar from the piston. These valve discs are so ported and arranged that on a movement of the hand controlled disc, pressure is admitted to one end of the cylinder and exhausted from the other end, thereby producing a movement of the piston which brings the ports in the other disc to the same relation that they originally bore to the hand controlled disc. After either a complete reversal or only a "hooking-up" of the motion, the pressure is held on both sides of the piston, thereby locking it at any point. From this it will be seen that should any excessive strain be set up in the reach rod, causing a movement of the piston, a compensating admission of pressure would take place on the opposite side of the piston. The point of cut-off is indicated by the position of the lever on the quadrant, corresponding to the hand type of lever, thereby guarding against confusion to inexperienced enginemen.

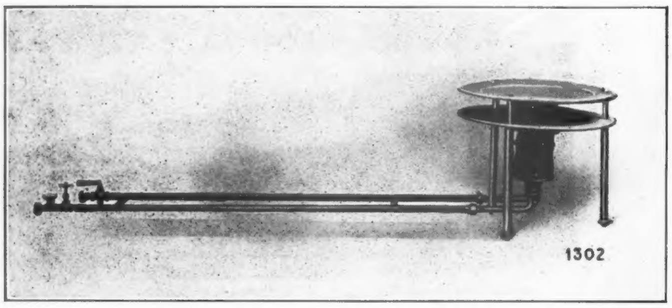
The cylinder is compact and can readily be attached to the boiler, firebox or running board in a substantial manner without interfering with other parts of the locomotive. The space occupied in the cab is very small, the travel of the handle being about 16 in.; the maximum pull necessary is from 12 to 15 lbs. The device is preferably operated by air pressure, but provision is made for the use of steam in the event of trouble with the air system. The total weight of the gear for a simple locomotive is about 375 lbs., and for a Mallet about 500 lbs.

Reports from applications made thus far are extremely satisfactory and seem to indicate that the device fills a long felt want, as it is reliable and at the same time so simple that it adds little or nothing to the cost of maintenance. A gear designed on similar lines and equipped with a positive mechanical locking device has also been developed by this company for fast passenger locomotives.

PAINT ON RUSTED SURFACES.—As a result of a series of experiments carried out by him, Dr. J. Newton Friend considers that a single coating of rust on ironwork to be painted is an advantage, as it permits a thinner paint to be used, and also enables it to grip better. An ordinary thick coating of rust, however, is objectionable.—*The Engineer.*

TIRE HEATERS

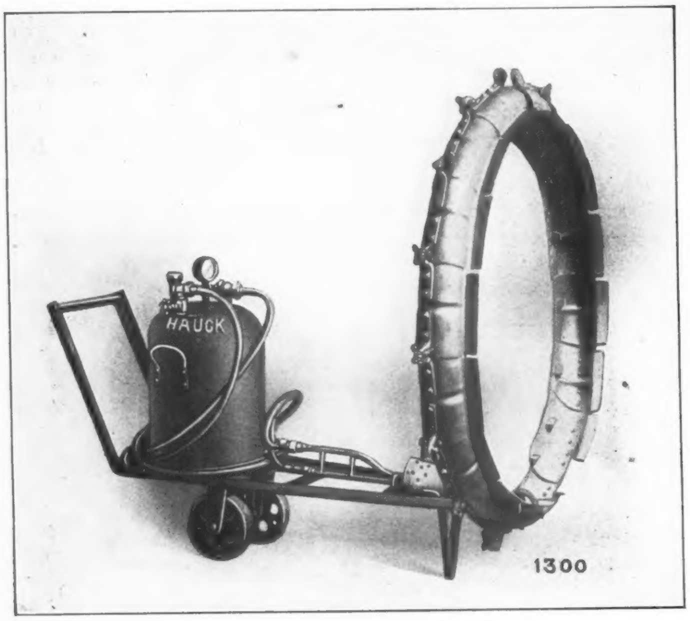
It has been claimed that a tire can be expanded and removed from the wheel center after ten minutes heating, but in these claims the time for attaching and removing the heater is not mentioned. In the development of the Hauck portable tire heater for roundhouse and similar work, it has been considered of prime importance to use the least possible time in attaching and detaching the outfit. The flexible casing of this heater is made up of sectional interchangeable steel segments in any num-



Hauck Stationary Tire Heater.

ber required and of the general form shown. Attached to these segments are brackets furnished with an index to assist in setting to any required diameter of tire. A steel frame truck is provided, if desired. These heaters are adapted for burning crude oil, and the tire casing can be adjusted to fit tires from 33 in. to 96 in. in diameter.

For mounting new or old tires it is customary to heat as many sets as can be conveniently handled by the force or equipment



Hauck Portable Tire Heater.

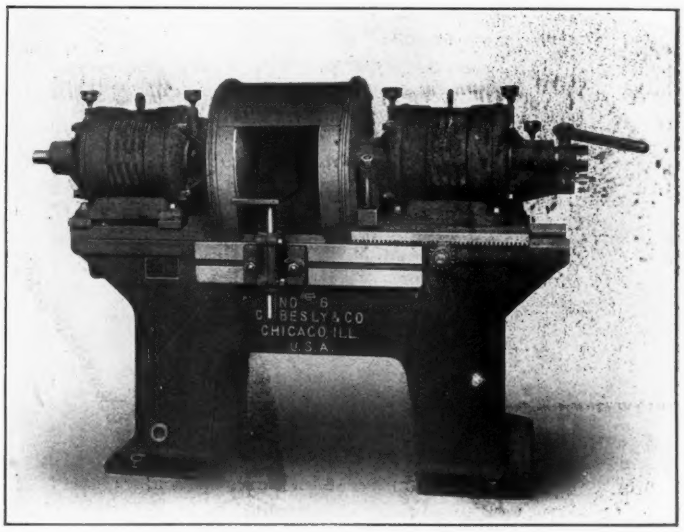
available. The Hauck stationary type tire heater consists of a single Hauck special oil burner which is placed in the center of the nest of tires to be heated. It can be instantly lighted and readily adjusted to suit conditions. The flame is directed against the inside diameter of the tires, heating them quickly and evenly. It is claimed that a single burner machine is more easily started and controlled than one with two or more burners.

September Anthracite Shipments.—The total shipments of anthracite coal from Pennsylvania in September were 5,572,279 tons as against 5,876,496 tons in September, 1912.

DOUBLE SPINDLE GRINDER

A new 18-in. disc grinder, having several interesting features, has been developed by C. H. Besly & Company, Chicago. It has two discs for grinding two parallel surfaces simultaneously, each being directly mounted on the shaft of a motor. The right-hand motor and its disc can be moved by means of a gear and rack, and clamped at any desired distance within a maximum of 10 inches from the other disc. In order to bring the discs in contact with the work the shaft and disc of the right-hand motor can be moved forward about one inch by means of the lever at the end of the shaft. A micrometer stop screw, graduated to .001 in., limits this motion so that work can be ground accurately to gage and then duplicated.

The dust hood telescopes automatically as the distance between the discs is varied. Ten work tables, varying in size from ¼ in. to 5 5/16 in. in width, and suitable for all sizes of work



Double Grinder with Adjustable Head.

within the capacity of the machine, are regularly furnished.

The motors are of the Westinghouse steel frame induction type with special bearing brackets to carry the unusually large bearings required for grinding service. The capacity of each is 5 horsepower.

Ceylon's Railways.—The railways of Ceylon are owned by the government, and there were 577 miles of line in operation at the end of June, 1911. Certain lines from Ratnapara to Mannar are under construction, while the construction of the Chilaw line has been authorized.

The Brick Arch and Smoke.—The brick arch, by retaining heat and retarding the flow of the gases, permits their ignition, while without the arch they would escape without reaching the ignition point, and a portion at least would form smoke. The amount of smoke reduction, although comparatively small, is sufficient to warrant consideration, and application of arches alone or in combination with other devices.—*D. F. Crawford before the International Society for the Prevention of Smoke.*

Cape to Cairo Railway.—In an article dealing with the construction of the Cape to Cairo Railway, a writer in *Colonial Life* says: "The work has been stupendous and the difficulties immense. There have been the unfriendly attitude of the natives to contend with and overcome; encounters with lions, elephants, and other wild beasts in the northwestern parts of Rhodesia; and then, as the Congo was approached, the ravages of the white ant and other termites had to be reckoned with.—*The Engineer.*

NEWS DEPARTMENT

Intoxicating liquors cannot be sold in railroad cars in the state of Ohio after November 4, the attorney general having advised the state authorities that the constitution forbids the maintenance of "moving saloons."

The United States Civil Service Commission announces examinations for telegraph and telephone engineers, senior and junior, and for telegraph and telephone inspector for service under the Interstate Commerce Commission in valuation of the property of common carriers.

The new locomotive shops of the Wabash at Decatur, Ill., were opened on October 18, and 200 men employed at the Springfield shops have been moved, or will move to Decatur to take positions in the new shops, to which has been transferred much of the machinery from the old plant. Officers of the Wabash held a banquet in Decatur on the evening of October 18.

The International Railway Fuel Association has grown from an initial membership of 35 on November 20, 1908, to 615, the present membership. With a view of attempting to increase the membership to a minimum of 1,000 before the annual meeting to be convened in May, 1914, the executive committee has made a special appeal to every member to secure at least one new member.

SAFETY FIRST ON THE GRAND TRUNK

The Grand Trunk Railway of Canada, on which George Bradshaw has been promulgating "safety-first" ideas, has issued a placard 10 in. x 6½ in., the substance of which is reprinted below. The lettering is blue and red on white cardboard—a red, white and blue effect. At each corner in the border is a print of the safety first button.

GRAND TRUNK RAILWAY SYSTEM.

THE PLEDGE.

I will Railroad according to the Book of Rules. I will do all in my power to guard against unsafe acts on my part. If I see a fellow employee doing his work in an unsafe manner, I will speak to him, as a friend, and use my moral influence to have him perform his duties in the Safest Possible Manner. I will remember and practice at all times SAFETY FIRST.

EIGHTY-THREE PER CENT. of all persons injured on railroads are YOU MEN WHO WORK FOR THE ROADS. SIXTY-SIX PER CENT. of all preventable injuries sustained by you are DUE TO UNSAFE PRACTICES which you could avoid.

MEETINGS AND CONVENTIONS

American Society of Mechanical Engineers.—A new centrifugal pump with helical impeller will be the subject of a paper to be presented Tuesday, November 11, by C. V. Kerr, sales engineer of the A. S. Cameron Steam Pump Works, New York. Discussion will follow in which all are invited to take part. An informal dinner (à la carte) will be served at 6:30 p. m.

Railway Business Association.—The fifth annual meeting and dinner will be held Thursday, December 11, at the Waldorf-Astoria Hotel, New York. The business meeting will be at 11 a. m.; the election of officers at 1:30 p. m., and the dinner at 7 p. m. promptly. The speakers will be Howard Elliott, chairman, New York, New Haven & Hartford, and the Hon. James M. Cox, Governor of Ohio. A feature of the dinner last year was that numerous members invited citizens in position to influence public opinion and governmental policy, and the general executive committee expresses the hope that this plan may become still more general this year.

Car Foremen's Association of Chicago.—The annual election of officers of the Car Foremen's Association of Chicago, held October 13, resulted as follows: President, George F. Laughlin, general superintendent, Armour Car Lines; first vice-president, C. J. Wymer, general foreman, Belt Railway; second vice-president, A. Le Mar, master mechanic, Pennsylvania Railroad; treasurer, M. F. Covert, assistant master car builder, Swift & Company; secretary, Aaron Kline, 841 North Fiftieth court, Chicago. The election was followed by a banquet, vaudeville and dance. The association is in a prosperous condition, having a membership of 876 practical car men.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting of mechanical associations.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.

AMERICAN RAILWAY MASTER MECHANICS' ASSOC.—J. W. Taylor, Old Colony building, Chicago.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—A. R. Davis, Central of Georgia, Macon, Ga.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Annual meeting, December 3-6, Engineering Societies' Building, New York. Railroad session, Thursday morning, December 5.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North Fiftieth Court, Chicago; 2d Monday in month, Chicago.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—S. Skidmore, 946 Richmond street, Cincinnati, Ohio.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. G. Hall, 922 McCormick building, Chicago. Convention, May 18-22, 1914, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 829 W. Broadway, Winona, Minn.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago.

MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y.

RAILROAD CLUB MEETINGS

Club.	Next Meeting.	Title of Paper.	Author.	Secretary.	Address.
Canadian	Nov. 11	Conservation Through Railway Electrification	G. P. Cole	Jas. Powell	Room 13, Windsor Hotel, Montreal.
Central	Nov. 14	From Mine to Mold	H. B. B. Yergason	H. D. Vought	95 Liberty St., New York.
New York	Nov. 21	Past, Present and Future of Railway Clubs.	Daniel M. Brady	H. D. Vought	95 Liberty St., New York.
Pittsburgh	Nov. 28	Workmen's Compensation	C. W. Garrett	J. B. Anderson	Union Station, Pittsburgh, Pa.
Richmond	Nov. 10	Election of Officers		F. O. Robinson	C. & O. Ry., Richmond, Va.
St. Louis	Nov. 14	The Democratic Side of Public School Work	Prof. A. R. Moyan	B. W. Frauenthal.	Union Station, St. Louis, Mo.
Western	Nov. 18	Not announced	J. H. Tinker	Jos. W. Taylor	390 Old Colony Bldg., Chicago, Ill.

PERSONALS

It is our desire to make these columns cover as completely as possible all the changes that take place in the mechanical departments of the railways of this country, and we shall greatly appreciate any assistance that our readers may give us in helping to bring this about.

GENERAL

The office of assistant superintendent of motive power of the Missouri, Kansas & Texas, at Denison, Tex., heretofore held by N. L. Smithan, has been abolished, and Mr. Smithan has been transferred to the mechanical department at Waco, Tex.

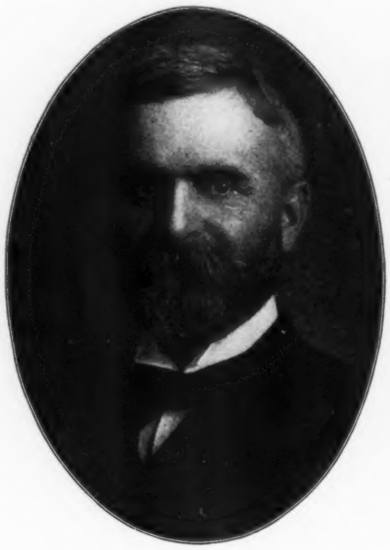
H. T. BENTLEY, principal assistant superintendent of motive power and machinery of the Chicago & North Western, has been appointed superintendent of motive power and machinery, succeeding Robert Quayle, promoted. Mr. Bentley was born June 4, 1862. He was educated at Dulwich College, and began railway work in 1877 with the London & North Western of England, where he was employed as an apprentice machinist until 1887. He was then for five years foreman of enginehouse of the same road at Chester, England. In 1892 he began work for the Chicago & North Western as machinist at the Chicago shops. Later he was made foreman of shops at Boone, Iowa, and from 1895 to 1898 was foreman at Belle Plaine, Iowa. He was then general foreman at Clinton, Iowa, and subsequently from April 1 to December 30, 1899, was master mechanic of the Madison division. Mr. Bentley was transferred to the Iowa division as master mechanic on January 1, 1900, where he remained until August 31, 1902, when he was appointed assistant superintendent of motive power and machinery at Chicago, the positon he now leaves. Mr. Bentley was president of the Western Railway Club 1906-1907; president of the American Railway Master Mechanics' Association 1911-1912, and president of the International Railway Fuel Association 1912-1913. He is chairman of the sub-committee of mechanical officials of the General Managers' Association of Chicago for the prevention of smoke in the city of Chicago, and also is a member of the Headlight Committee of the Master Mechanics' Association. Mr. Bentley also is a member of the American Society of Mechanical Engineers.

H. T. Bentley.

B. B. MILNER, assistant master mechanic of the Philadelphia, Baltimore & Washington at Wilmington, Del., has been appointed special engineer on the staff of the senior vice-president of the New York Central Lines with headquarters at New York. He began railway work as a machinist's helper in the Parsons, Kan., shops of the Missouri, Kansas and Texas, resigning in 1900 to enter the mechanical engineering school of Purdue University from which he graduated in 1904. He then entered the service of the Pennsylvania Railroad as special apprentice at the Altoona shops. From September, 1904, to the following year he was engaged in work under E. D. Newson, engineer of tests, and chairman of the committee appointed by the Association of Transportation Officers to investigate "The Low Mileage of Freight Car Equipment" and then was special representative of the superintendent of motive power. In the fall of 1905 he was again assigned by the engineer of tests to special work and in 1906 was placed in charge of planning a rearrangement in the location of machine tool equipment at the Altoona Shops. During the first half of 1908 he was sent to the west to visit the principal railway shops for the collection of ideas on betterment methods and practices and for a short time was engaged in putting these into effect. During 1908 and 1909 he was engaged in special work under the direction of H. M. Carson, then assistant to the general manager of the Pennsylvania Railroad at Philadelphia, and continued special work under his successor, J. E. Rogers, principally upon the study of betterment problems. He was appointed assistant master mechanic at Wilmington, Del., in May, 1911, but was temporarily relieved of his duties in 1912 to handle the preparation under the general manager at Philadelphia of the Pennsylvania's case for presentation to the board arbitrating the engineers' demands for increases in wages and adjustments of working conditions. He was engaged in similar work in the firemen's arbitration in 1913, under the direction of the chairman of the conference committee of managers and since January, 1913, when he was relieved of those duties, he has again been engaged as assistant master mechanic at Wilmington.

HARRY W. HINMAN, apprentice school instructor of the Atchison, Topeka & Santa Fe, at Topeka, Kan., has been transferred from 422 Buchanan street to 705 West street.

MAJOR CHARLES HINE, vice-president of the Southern Pacific of Mexico and the Arizona Eastern, has resigned, effective October 16, to return to the field of expert railway work along organization and efficiency lines. He already has been employed to do work along these lines on the Canadian Northern and while engaged on this his headquarters will be at Toronto, Ont. His permanent headquarters, however, will be at New York City. Major Hine was born March 15, 1867, at Vienna, Va., and was graduated from the Washington (D. C.) high school in 1885 and from the United States Military Academy at West Point in 1891. He was graduated from the Cincinnati Law School and admitted to the bar in 1893 while serving as lieutenant in the United States Army. He began railway work in April, 1895, and for three years was employed by the Cleveland, Cincinnati, Chicago & St. Louis successively as freight brakeman, switchman, yardmaster, conductor, chief clerk and trainmaster of the Cincinnati-Indianapolis district. He was then granted leave of absence in April, 1898, to serve in the Santiago campaign of the Spanish-American war as Major U. S. Volunteers, returning to the Big Four in February, 1899, as trainmaster at Cincinnati, O. In September of that year he was made general superintendent of the Findlay, Ft. Wayne & Western. He was inspector of safety appliances for the Interstate Commerce Commission in 1900, resigning November 1 of that year to go to the Chicago & Alton as assistant superintendent at Roodhouse, Ill. Major Hine was receiver of the Washington, Arlington & Falls Church Electric railway 1907 to 1908, and subsequently held various staff positions in special work and



Charles Hine.

reports on the Chicago & Alton, Chicago, Rock Island and Pacific, St. Louis & San Francisco, Chicago & Eastern Illinois, Chicago, Burlington & Quincy, Erie, Intercolonial, Prince Edward Island, Delaware & Hudson, Georgia & Florida railroads and National Railways of Mexico as well as other smaller roads. While with Gunn, Richards & Company, in 1907, he assisted in a revision of the business methods in the Department of the Interior at Washington, D. C. As temporary special representative of President Taft in 1910, he outlined a programme for improving organization and methods of executive departments of the United States government. From July, 1908, to December, 1911, as organization expert for the Union Pacific and Southern Pacific, he originated and installed the Hine unit system of organization. He was then in January, 1912, made vice-president and general manager of the Southern Pacific of Mexico and the Arizona Eastern, which position he now resigns, as above stated. Major Hine is the author of "Letters from an Old Railway Official to His Son," published by the *Railway Age Gazette*, and of other works.

ROBERT QUAYLE has been appointed general superintendent of the motive power and car departments of the Chicago & North Western, with headquarters at Chicago, Ill. Mr. Quayle was born at Douglas, Isle of Man. He began railway work with the Chicago & North Western in 1871 as machinist apprentice and until June, 1885, was successively journeyman machinist, gang boss and foreman. He was then promoted to the position of master mechanic and nine years later, on December 1, 1894, was made superintendent of motive power and machinery. After serving in the latter capacity for 19 years he will on November 1 become general superintendent of the motive power and car departments, with headquarters at Chicago, as above noted. Mr. Quayle was president of the Railway Master Mechanics' Association, 1898-1899.

Robert Quayle.

J. E. O'BRIEN, superintendent of motive power of the Western Pacific at Jeffery Shops, Cal., has been appointed assistant mechanical superintendent of the Missouri Pacific and St. Louis, Iron Mountain & Southern, with headquarters at St. Louis, Mo.

HARRY ROSE WARNOCK, has been appointed superintendent of motive power of the Western Maryland, with headquarters at Hagerstown, Md. Mr. Warnock was born on July 16, 1870, at Newcastle, Pa., and was educated in the public schools. He began railway work in June, 1889, with the Pennsylvania Lines West of Pittsburgh as a freight brakeman, and later in the same year went to the Pittsburgh & Lake Erie as a brakeman. He was then locomotive fireman and later engineman on the same road. From May, 1901, to May, 1904, he was consecutively engine despatcher, roundhouse and general foreman on the Monongahela division of the same road, and then to October, 1905, was master mechanic of the West Side Belt, at Pittsburgh, Pa. In October, 1905, he became general foreman of the Monongahela Railroad and was subsequently made master mechanic of that road, which positon he held at the time of his recent appointment as superintendent of motive power of the Western Maryland, as above noted.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

E. L. AKANS has been appointed master mechanic of the Virginia & Southwestern at Bristol, Va.-Tenn., succeeding J. W. Gibbs.

W. U. APPLETON, assistant to superintendent of motive power of the Intercolonial, at Moncton, N. B., has been appointed general master mechanic of the Intercolonial and the Prince Edward Island railways, in charge of all engine houses and shops (except Moncton shops), locomotives and machinery, with headquarters at Moncton.

W. E. BARNES has been appointed district master mechanic, district No. 3 of the Intercolonial, with office at Moncton, N. B.

JOHN C. BASFORD has been appointed assistant road foreman of engines of the Philadelphia division of the Baltimore & Ohio, with headquarters at Baltimore, Md.

H. G. CASTRON has been transferred as master mechanic of the Chicago, Burlington & Quincy from Beardstown, Ill., to Brookfield, Mo.

GILBERT DEMPSTER has been appointed master mechanic of the Southern Railway Company in Mississippi, with headquarters at Columbus, Miss., succeeding F. E. Patton, promoted.

J. T. FLAVIN, master mechanic, has assumed charge of the locomotive and car departments of the Chicago, Indiana & Southern, with headquarters at Gibson, Ind., reporting to the superintendent and the jurisdiction of D. R. MacBain, superintendent of motive power, has been withdrawn.

W. J. FRAUENDIENER has been appointed master mechanic of the Eastern division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Bellefontaine, Ohio, succeeding J. T. Luscombe, resigned.

J. W. GIBBS has been appointed master mechanic of the Southern Railway at Sheffield, Ala., succeeding Frank Johnson.

GEORGE A. MORIARTY, whose appointment as master mechanic of the New York, New Haven & Hartford, with headquarters at South Boston, Mass., was announced in the October number, was born on July 24, 1872, at Connellsville, Pa., and was educated in the schools of Cincinnati and the high schools of Newark, Ohio. He began railway work in February, 1887, as a machinist apprentice on the Baltimore & Ohio, and from March, 1891, to September, 1895, was machinist successively on the Pennsylvania Railroad, the Baltimore & Ohio, the Louisville & Nashville, the Cincinnati, New Orleans & Texas Pacific, and the Cleveland, Cincinnati, Chicago & St. Louis. He then returned to the service of the Baltimore & Ohio as machinist, and was subsequently machine shop foreman and general foreman on the same road. From August, 1898, to July of the following year he was in a contract shop, and then to May, 1903, was first a gang foreman on the Baltimore & Ohio, then roundhouse foreman, and later general foreman. In June, 1903, he went to the Erie as general foreman, and later became

G. A. Moriarty.

master mechanic, leaving that company in August, 1907, to become master mechanic of the New York, New Haven & Hartford on the Old Colony division at Providence, R. I., which position he held at the time of his recent appointment as master mechanic.

A. E. Hale has been appointed road foreman of engines of the Tucson division of the Southern Pacific, with headquarters at El Paso, Tex., succeeding H. Moore.

T. W. Hennesy has been appointed district master mechanic, district No. 2 of the Intercolonial, with office at Campbellton, N. B.

F. Hodnapp has been appointed road foreman of engines of the Baltimore & Ohio Southwestern, with headquarters at Flora, Ill.

Mark Jefferson has been appointed assistant master mechanic of the Lehigh Valley, with office at Easton, Pa.

Frank Johnson has been appointed master mechanic of the Southern Railway at Birmingham, Ala., succeeding E. M. Sweetman.

George J. Kintz has been appointed division foreman of the Atchison, Topeka & Santa Fe at Deming, N. M., succeeding George A. Belcher.

C. A. McCarthy, master mechanic of the Chicago, Rock Island & Pacific at Shawnee, Okla., has resigned to become master mechanic of the Colorado Springs & Cripple Creek District Railway, with office at Colorado Springs, Colo.

H. D. McKenzie, general locomotive foreman of the Intercolonial at Moncton, N. B., has been appointed district master mechanic, district No. 4, with office at Stellarton, N. S.

H. S. Mored, master mechanic of the Chicago, Burlington & Quincy at Ottumwa, Iowa, has been appointed master mechanic at Aurora, Ill., succeeding J. B. Roach, transferred.

F. W. Nelson, whose appointment as master mechanic of the Western division of the New York, New Haven & Hartford, with headquarters at Waterbury, Conn., was announced in the October number, was born on April 25, 1876, at Ogdensburg, N. Y., and was educated in the high schools. He began railway work in December, 1900, as a fireman on the New York, New Haven & Hartford, and has been in the continuous service of that road ever since. In March, 1903, he was made engineman, and from December, 1910, to May, 1913, he was road foreman of engines. He was promoted to general road foreman of engines on May 1, 1913, which position he held at the time of his recent appointment as master mechanic of the western division of the same road, as above noted.

W. J. O'Neill has been appointed master mechanic of the Panhandle and Indian Territory divisions of the Rock Island Lines, with office at Shawnee, Okla., succeeding C. A. McCarthy, resigned to accept service with another company.

J. B. Roach, master mechanic of the Chicago, Burlington & Quincy at Aurora, Ill., has been transferred to Beardstown, Ill., in a similar capacity, succeeding H. G. Castron, transferred.

W. F. Ross has been appointed road foreman of engines of the Baltimore & Ohio, with headquarters at Benwood Junction, W. Va., succeeding J. F. Little.

H. W. Sharpe, acting master mechanic of the Intercolonial at Riviere du Loup, Que., has been appointed district master mechanic, district No. 1, of the Intercolonial, with office at Riviere du Loup.

G. M. Stone has been appointed master mechanic of the Oklahoma division of the Rock Island Lines, with headquarters at Chickasha, Okla., succeeding W. J. O'Neill, transferred.

D. R. Sweney has been appointed master mechanic of the Chicago, Burlington & Quincy at Ottumwa, Iowa, succeeding H. S. Mored, transferred.

K. Tate has been appointed assistant master mechanic of the Eastern division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Bellefontaine, Ohio.

E. M. Sweetman, master mechanic of the Southern Railway at Birmingham, Ala., has been appointed master mechanic with headquarters at Princeton, Ill., succeeding G. N. Howson, promoted.

Harry Whitham has been appointed division foreman of the Atchison, Topeka & Santa Fe Coast Lines at Gallup, N. Mex., succeeding George E. Johnson.

CAR DEPARTMENT

Albert A. Allison has been appointed car foreman of the Atchison, Topeka & Santa Fe at West 38th Place, Chicago, succeeding Frank Wilkinson.

George E. Smart has been appointed master car builder of the Intercolonial and the Prince Edward Island railways, with headquarters at Moncton, N. B.

J. W. Senger has been appointed master car builder of the Lake Shore & Michigan Southern, with headquarters at Collinwood, Ohio, succeeding I. S. Downing, resigned. Through a typographical error in the October issue Mr. Senger's appointment was confused with that of Mr. Downing.

W. K. Smith has been appointed car foreman of the Rock Island Lines at Hulbert, Ark., succeeding J. Barnett, resigned.

F. C. Watrous has been appointed assistant foreman of car repairs of the Erie Railroad at Kent, Ohio, succeeding Louis Krall, resigned.

E. M. Wilcox has been appointed general car foreman of the Chicago, Indiana & Southern, with headquarters at Gibson, Ind.

SHOP AND ENGINE HOUSE

M. D. Chase has been appointed general foreman of the Missouri, Kansas & Texas at Smithville, Tex., succeeding George Hilferink, resigned.

John C. Cole has been appointed roundhouse foreman of the Rock Island Lines at Pratt, Kan., succeeding W. H. Graves, transferred.

Frank J. Echle has been appointed general shop inspector of the Lake Shore & Michigan Southern and the Dunkirk, Allegheny Valley & Pittsburgh, with headquarters at Collinwood shops, Cleveland, Ohio, succeeding Joseph J. Schultz, transferred.

Jos. Graham, erecting shop foreman of the Intercolonial at Moncton, N. B., has been appointed superintendent of the locomotive shops at that point, succeeding H. D. McKenzie, general locomotive foreman, transferred.

E. P. Joyce has been appointed roundhouse foreman of the Erie Railroad at Kent, Ohio, succeeding M. J. Harrison, resigned.

A. J. Krueger has been appointed assistant general shop inspector of the Lake Shore & Michigan Southern and the Dunkirk, Allegheny Valley & Pittsburgh, with headquarters at Collinwood shops, Cleveland, Ohio, succeeding W. S. Gunther, transferred.

H. H. Parker, roundhouse foreman of the Seaboard Air Line at Portsmouth, Va., has been appointed general foreman at that point.

J. C. Scanlon has been appointed roundhouse foreman of the Erie Railroad at Brier Hill, Ohio, succeeding W. R. Thracht, transferred.

PURCHASING AND STOREKEEPING

J. M. KILLIAN has been appointed storekeeper of the St. Louis Southwestern lines, and will have charge of all miscellaneous supplies and material other than ties, timber, piling, lumber and fuel, with headquarters for the St. Louis Southwestern at Pine Bluff, Ark., and for the St. Louis Southwestern of Texas at Tyler, Tex. He succeeds N. A. Waldron, resigned.

WILLIAM R. SHOOP, purchasing agent of the Buffalo, Rochester & Pittsburgh, at Rochester, N. Y., has been appointed manager of purchases and stores, with headquarters at Rochester, N. Y.

N. A. WALDRON, formerly storekeeper of the St. Louis Southwestern, has been appointed general storekeeper of the Missouri, Kansas & Texas, with headquarters at Parsons, Kan., succeeding J. M. Gibbons, resigned.

OBITUARY

JOHN F. ENSIGN, chief inspector of locomotive boilers, in the Division of Locomotive Boiler Inspection, of the Interstate Commerce Commission, died on September 24, after a long illness, at his home in Washington, D. C. He was born on March 23, 1862, at Marathon, N. Y. As a young man he went to Colorado and began railway work with the Chicago, Burlington & Quincy as a blacksmith. He later was made machinist, and subsequently became fireman and engineman. Nine years ago he was appointed an inspector in the Division of Safety Appliances of the Interstate Commerce Commission; and on March 2, 1911, was appointed chief inspector of locomotive boilers by President Taft, with headquarters at Washington. He was a member of the Brotherhood of Locomotive Engineers and a member of the Washington Society of Engineers. Mr. Ensign had spoken on safety appliances and the inspection of locomotive boilers before different railway clubs and other organizations.

J. F. Ensign.

NEW SHOPS

CHICAGO & WESTERN INDIANA.—This company has prepared plans for a roundhouse, locomotive shop, machine shop, storehouse, turntable and ash pits to be built near its yards now under construction at Clearing, Ill.

ILLINOIS CENTRAL.—This company has given a contract for building a new roundhouse at Nonconnah, Tenn.

NATIONAL TRANSCONTINENTAL.—A contract has been let to J. Gosselin, Levis, Que., for putting up machine and other shop buildings at St. Malo, Que.

NORFOLK SOUTHERN.—A six stall, square engine house is to be built at North Brevard street, Charlotte, N. C. The building is to be of brick construction, 90 ft. x 100 ft., and will cost about $15,000.

SUPPLY TRADE NOTES

The American Steel Foundries, Chicago, has moved its general offices from the National Bank building to the eleventh and twelfth floors of the McCormick building, Chicago.

The Galena Signal Oil Company of Franklin, Pa., has bought about three acres of land at Clearing, Ill., on which to build steel storage tanks, a concrete and brick warehouse, and a power plant.

J. B. Kilpatrick, formerly mechanical superintendent for the First district of the Rock Island Lines, with office at Des Moines, Iowa, has been made a vice-president of the Chicago Air Brake Company, with office in Chicago.

E. E. Hudson has been made fourth vice-president of Thomas A. Edison, Inc., Orange, N. J., with office at Orange. Mr. Hudson will continue as heretofore in charge of the sales of the Primary battery department.

Chester H. Jones has been placed in charge of the steam railroad department of the General Electric Company's new St. Louis district office. Mr. Jones has been connected with the steam railroad department in the Chicago territory.

Blake C. Howard, heretofore southwestern sales manager of Mudge & Co., has opened offices in the Railway Exchange building, St. Louis, Mo., to handle a general line of railway supplies. He will continue to represent Mudge & Co., together with other accounts.

H. E. PASSMORE has resigned as master mechanic of the Toledo & Ohio Central to become vice-president of the Grip Nut Company, Chicago, in charge of sales in the eastern district. He will have headquarters for the present at Bucyrus, Ohio. Mr. Passmore was born at York, Pa., in November, 1869, and was educated at York Collegiate Institute and the Maryland Institute at Baltimore, Md. He served his machinist's apprenticeship with the Pennsylvania at Altoona, Pa., and worked as a machinist for the Norfolk & Western, Baldwin Locomotive Works, Philadelphia & Reading and Western Maryland. In 1903 he entered the service of the Toledo & Ohio Central as machinist, and advanced through the ranks to the position of master mechanic, which position he leaves on November 1 to enter the supply field. Mr. Passmore has been an active member of the Master Mechanics' and of the Master Car Builders' Associations, is now a member of some of the more important committees, and has a host of friends who welcome him into his new field of endeavor.

H. E. Passmore.

The Transue & Williams Company, Alliance, Ohio, has purchased all of the assets of the Davies-Bach Manufacturing Company, including the plant recently erected in Alliance for making steel stampings. It is expected to operate this plant, which is to be known as the steel stamping department of the Transue & Williams Company, and also to enlarge it materially in order to conduct a general steel stamping business. The

company also expects to add from 60 to 80 per cent. to the capacity of its present drop forge plant, and is now contracting for new buildings and additional machinery. When the new equipment is in place, about 200 additional men will be employed.

The Chicago-Cleveland Car Roofing Company has let building contracts for an addition to its Cleveland works and the work is now under way. The entire Cleveland plant is now operated by individual electric motors recently installed. Besides the Cleveland plant, this company is now manufacturing at three different points in Canada.

The International Oxygen Company has moved its executive offices from 115 Broadway, New York, to the works at Newark, N. J. Additional buildings have been erected for the offices and also to provide additional manufacturing room for the increased demands made upon the plant. The general sales offices will remain at 115 Broadway, New York, as heretofore.

C. C. BRADFORD, manager of the Cleveland office of the United States Light & Heating Company, New York, has been made sales manager of that company, with office in New York; and R. B. Clark has been made acting manager of the Cleveland office, succeeding to the duties of Mr. Bradford. Mr. Bradford was born in Caldwell, Kan., on May 27, 1880. In his early youth he moved to Cleveland, Ohio, where he received his schooling. He graduated from the Case School of Applied Science in the electrical course. Mr. Bradford started his business career with the Willard Storage Battery Company, Cleveland, and became manager of the Chicago office of that company and then manager of the New York office. He resigned the latter position to go to the General Vehicle Company, Long Island City, as assistant sales manager. He remained with that company until 1909, when he was made manager of the New York office of the United States Light & Heating Company. After one year the branch office at Cleveland, Ohio, was established and Mr. Bradford was made manager, which position he retained until his appointment as sales manager, with office at New York, as mentioned above.

C. C. Bradford.

Benjamin Tucker Lewis, western manager of the Railway Appliances Company, Chicago, died on October 11. Mr. Lewis was born in Madison county, Indiana, June 8, 1853. He began his business career as clerk and private secretary to the president of the Chicago & Iowa and Chicago, Pekin & Southwestern Railways in 1872, later becoming secretary and director, and also purchasing agent and general passenger and ticket agent for these companies, the Chicago, St. Louis & Western and the Chicago & St. Louis until 1887. From 1887 to 1890 he was director of purchases and taxes and fuel agent of the Chicago, Santa Fe & California. From 1890 to 1900, he was assistant to the vice-president and general manager of the Santa Fe & Mexican Central, with residence at Topeka, Kan., to 1898, and at Mexico City 1898 to 1900. He became identified with the Railway Appliances Company in July, 1901.

CATALOGS

VALVES.—Renewable discs and disc holders are a special feature of the Jenkins Bros. valves, which are illustrated in a large variety of forms and sizes in a leaflet being issued by this company from 80 White street, New York.

CHUCKS—The Skinner Chuck Company, New Britain, Conn., has issued a catalog and price list describing its independent, universal and combination lathe chucks, as well as car wheel, planer and many other types of chucks.

RIVETING HAMMERS.—An eight page bulletin from the Ingersoll-Rand Company, 11 Broadway, illustrates a new line of Little David riveting hammers which are suitable for tank and boiler work which uses not larger than 1¼ in. diameter rivets.

BALDWIN FORTY THOUSANDTH LOCOMOTIVE.—Locomotive No. 8661, of the Pennsylvania lines west of Pittsburgh, which is one of thirty similar engines recently built by the Baldwin Locomotive Works, is the forty thousandth locomotive turned out by this company. It is a class K-3-s, Pacific type engine

CRANE MOTORS.—Direct current motors designed exclusively for crane service are shown in bulletin No. 109 from the Shaw Electric Crane Company, Muskegon, Mich. The bulletin fully describes all parts of the motor and the illustrations show its arrangement and construction.

GAS ENGINES.—A small bulletin from the Mesta Machine Company, Pittsburgh, Pa., briefly describing the general principles of this type of gas engine and illustrating a number of recent installations. This company builds gas engines for any class of service and for any fuel gas in sizes upward from 350 brake horsepower.

PIPE THREADING AND CUTTING TOOLS.—Hand operated pipe cutters and die stocks are illustrated in a variety of sizes and forms, all being suitable for operation by one man, in a catalog being sent out by The Borden Company, Warren, Ohio. These die stocks carry the trade name of Beaver and are shown for any size pipe up to 8 in. diameter.

ELECTRIC TOOLS.—A leaflet from The Van Dorn Electric Tool Company, Cleveland, Ohio, shows several types of portable electrically operated drilling, reaming and grinding machines. It is claimed in this leaflet that these electric tools will accomplish 50 per cent. more work than a pneumatic tool of the same capacity and at one-third the cost for power.

OPERATING INCANDESCENT LAMPS.—The General Electric Company has recently issued bulletin No. A-4142, which deals minutely with the various operating conditions which affect the efficiency and life of incandescent lamps. The subject is treated exhaustively and is prefixed by an explanation of definitions so that the context may be entirely clear. It is well illustrated.

STEEL CONVERTER.—The Whiting Foundry Equipment Company, Harvey, Ill., has recently developed a side blow steel converter which can be installed in a gray iron foundry and provide a means for furnishing steel castings from small to moderate size. This equipment, an example of which was recently installed in the foundry of the Delaware & Hudson Company, Watervliet, N. Y., is fully illustrated in bulletin No. 106.

MANUFACTURE AND USE OF STEEL TUBING.—An address by J. H. Nicholson and Emil Holinger before the U. S. Naval School of Marine Engineering on the subject of the manufacture and use of Shelby steel tubing is being reprinted in pamphlet form by the National Tube Company, Pittsburgh, Pa. This address is particularly noteworthy because of the comprehensive information it contains. The bulletin reproduces a series of illustrations showing the manner of forming various articles from seamless steel tubing and also gives a list of uses to which this material can be adopted. This includes nearly 400 items.